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Turbine Water Wheel Tests.

Some months ago a series of careful tests of turbine water wheels were conducted at Holyoke, Mass., by Mr. James Emerson and Mr. Samuel Webber, assisted by a corps of experts. Wheels were entered from almost every section of the country, and subjected to exhaustive tests to determine their efficiency at full and partial gate, under different loads and with different heads of water. The results given by each wheel have been tabulated, and will furnish valuable records for comparison. The Hercules wheel, made by the Holyoke Machine Company, gave the best results, and we are permitted this week to present engravings and the figures of the test of this wheel. The test was made Nov. 12, 1879, and gave the following record:

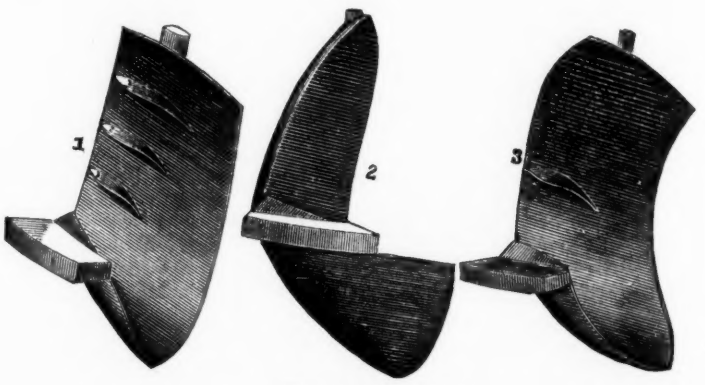
TESTS OF HERCULES WHEEL, 33 IN. DIAM., AT HOLYOKE FLUME, WIER 10 FEET WIDE. FRICTION PULLEY 20 FEET CIRCUMFERENCE.

No.	Load in pounds.	Rev. per Min.	Head—feet.	Weir in feet.	Cu. feet Water per Min.	H. P. Wheel.	H. P. Water.	Per centage of power.
1	1300	155.33	17.28	1.615	4732.11	122.38	154.45	.7924
2	1325	153.54	17.26	1.610	4710.31	122.46	153.54	.7975
3	1350	150.5	17.26	1.615	4732.11	123 14	154.28	.7982
4	1375	146.5	17.26	1.616	4736.48	122.08	154.42	.7906
5	1300	150	17.35	1.566	4519.69	118.18	148.14	.8000
6	1250	157	17.35	1.565	4515.39	118.94	148	.8036
7	1250	147.5	17.45	1.502	4246.77	111.74	139.98	.7983
8	1200	154.5	17.42	1.494	4213.02	112.36	138.62	.8107
9	1125	152	17.43	1.495	4217.24	112.85	138.85	.8127
10	1150	149.66	17.54	1.417	3892.45	104.31	128.96	.8042
11	1125	152.5	17.54	1.420	3904.79	103.98	129.94	.8000
12	1050	153.5	17.59	1.375	3720.09	97.68	123.63	.7901
13	1050	146	17.58	1.330	3539.76	92.91	117.55	.7904
14	1000	151	17.60	1.326	3523.8	91.52	117.15	.7812
15	975	154	17.62	1.318	3491.93	91	116.22	.7830
16	950	145	17.28	1.268	3294 82	83.48	107.54	.7763
17	900	145.5	17.31	1.262	3271.39	82.09	106.96	.7675
18	850	148	17.25	1.210	3070.61	76.24	100.05	.7620
19	825	151.25	17.25	1.206	3055.34	75.625	99.55	.7600
20	725	151	17.01	1.146	2829	66.66	90.89	.7334
21	650	153	17.20	1.084	2600.84	60.27	84.50	.7132
22	600	153.5	17.34	1.050	2478.28	55.82	81.7	.6877
23	600	150.5	17.39	1.040	2442.58	54.73	80.23	.6821
24	550	161	17.37	1.042	2449.70	53.67	80.37	.6677

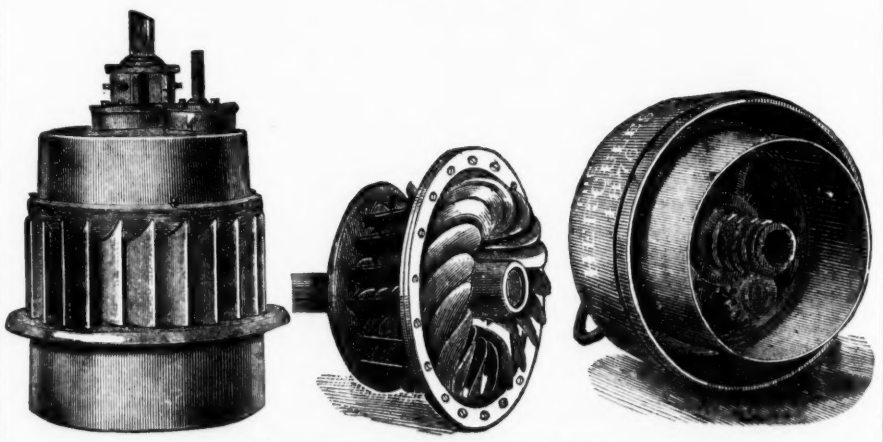
The Hercules wheel was designed to give the most desirable results at all points of the gate opening, or, in other words, the end in view was to design a wheel which would economize water at any stage of gate opening. This is a very desirable and necessary feature in the summer when streams are low and the water scarce, also in the fall and winter months when water is plenty as the force may be utilized in full. To do this turbine builders must be able to produce turbines that will give their best percentage at either one-half, five-eights, three-fourths, seven-eights, or whole gate, as may best adapt each for the place where it is to be used. Such a wheel should be good at any stage of gate opening, and when such can be produced with certainty, then turbine building may properly be considered a science, and not before, for such wheels are possible. Our rivers and streams are all extremely variable in supply of water—that of the summer months often being less than one-fourth of what it is for the rest of the year; and three-fourths of the larger quantity is almost invariably allowed to run to waste, because wheels of sufficient capacity to utilize the maximum have generally proved to be incapable of transmitting any power from the use of the minimum supply. Turbines have been so extravagant in the use of water at part gate that there are many old mill men who still believe the overshot wheel to be superior to it where the supply is variable.

In perfecting the "Hercules Wheel" numerous experiments were tried, during which the three kinds of buckets illustrated, have been tried, but the No. 1 proved by far the best, and that alone is now used. The buckets are cast separate and framed in, and may be made of brass or bronze if desired. Some manufacturers have lately produced wheels of much greater capacity than were supposed possible a few years since.

The manufacturers have aimed at the combination of the most valuable features contained in turbine wheels, and after many experiments have produced the wheel illustrated. The lines are well formed, and well calculated to give very excellent results.



FORMS OF BUCKETS.



HERCULES TURBINE WATER WHEEL.

It is very often desirable to run turbine wheels at partial gate, the same as steam engines are frequently worked at a part of their full power. A wheel that must be run at full gate, in order to give the best results, is not always the most economical. By referring to the diagram of power curves, on page 2, it will be seen that in the test, of which the summary is given in the foregoing table, the Hercules wheel utilized the highest per centage of power at about nine-tenths gate, and that a good portion of it was utilized at every position from half gate to full gate.

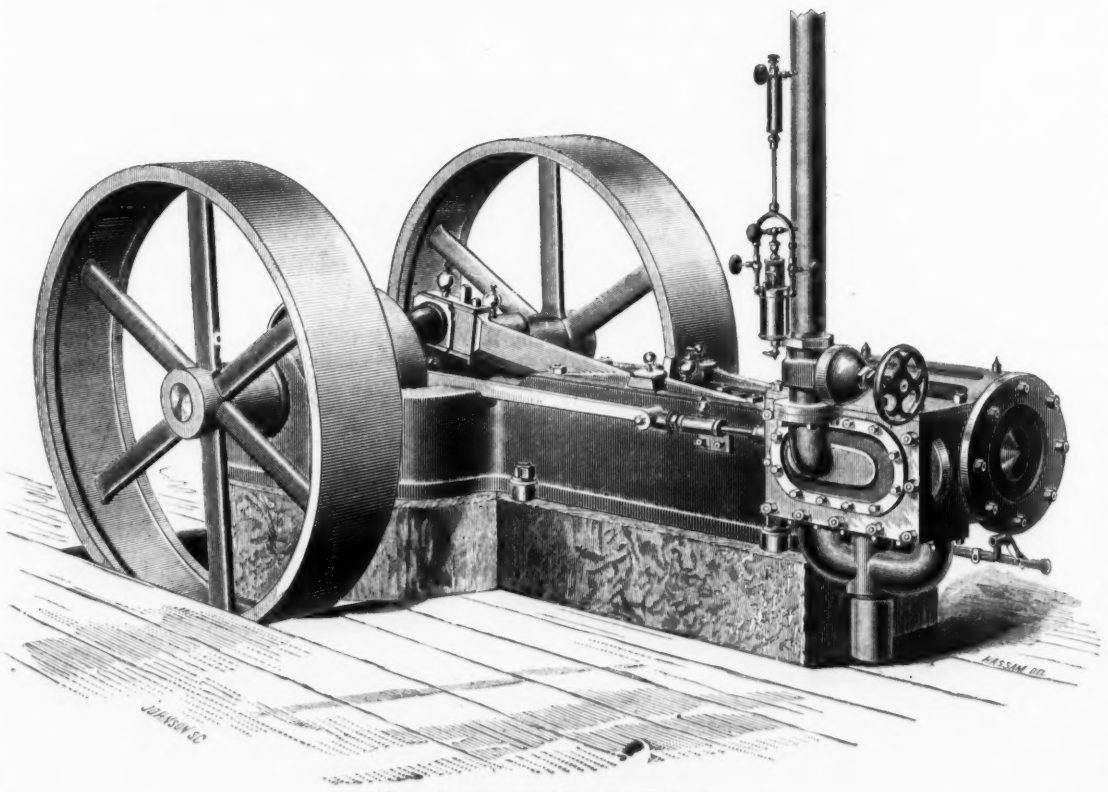
New Automatic Cut-Off Engine.

We present on this page an engraving of a new style of automatic cut-off engine adapted to the uses of those who desire moderate powers, economy and uniformity of speed. The first noticeable feature about this engine is that it is self contained. The form of the bed is such as to give the utmost strength and stiffness. The crank-shaft is of bent steel, thus giving a large bearing surface to the connecting-rod, and applying the power just where it is needed, that is, between the load. It has two balance-wheels, perfectly balanced.

The automatic cut-off regulator is attached to the crank-shaft, and takes hold of the valve-rod directly, thus avoiding all complicated rocker-arms. The valve is a flat balanced valve, which, it is claimed will not become leaky from use.

The cut-off acts instantaneously and controls the engine at the desired speed whatever may be the load, or pressure of steam, and, it is claimed, the variation from an extreme light load to the capacity of the engine will not exceed two per cent.

So far as workmanship and choice of materials are concerned, there seems to be nothing omitted. It is claimed that these engines are as simple as the ordinary throttling valve engine, and require as little care, at the same time the cost of fuel being less. The manufacturers are Armington & Sims, Lawrence, Mass., and the selling agents Hill, Clarke & Co., Boston, Mass.



NEW AUTOMATIC CUT-OFF ENGINE.

High speed in steamboats as well as in stationary engines and locomotives seems to be coming prominently into notice. A new steamboat on the Hudson River lately made over twenty-five miles an hour in her trial trip, and is expected to beat the other boats from New York to Albany from two to four hours. She is calculated to run thirty miles an hour under favorable circumstances. The rapid progress of steam engineering is developing some remarkable cases of fast locomotion, which are very favorably regarded by the public at large. Of course, machinery will sooner wear out if run at high speed, but full value may sooner be obtained from it.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * There is one institution which machine men would do well to patronize, and that is the junk shop. I don't mean as purchasers of junk material, but as sellers of such material. There is not one shop out of a hundred which would not be much better off after a thorough sale of the tons and tons of junk stuff which is eternally accumulating. If I am not mistaken I have expressed myself, in some former letter, regarding the accumulation of castings; such castings accumulate in many ways. They are made for stock and new changes in patterns throw these castings out of date. They are not worth saving and should be melted up or sold to a foundry for scrap. Other castings are found to be defective in size or quality. They are not worth saving a week. Other castings get made by mistake in the best regulated foundries. It is poor policy to save such castings. Better melt them up.

* * * * Besides new castings of great age there are old things saved from old jobs or culled from the scrap pile. It is the poorest kind of policy to keep money invested in such stuff.

The interests of the shop are never in any degree advanced by having some makeshift lump of iron on hand, which, while it can be made to answer a desired purpose, will never be a credit to a shop; will never yield the profit which a new price would; and will in principle tend to demoralize any shop harboring its kind.

* * * * Castings unfitted are the smallest part of the litter accumulating around the shop. The whole shop and the whole yard will often be found completely choked up with fragments of the wrecks of old repair jobs. These traps in fact furnish a complete index to the list of repair jobs done in a past year.

* * * * An old engine comes in for general repair. The cylinder is rebored and a new piston put in, but the old rings are always hung up under some vise bench.

These old rings never, under any circumstances, come into any use but are saved for years. They should go into the cast iron scrap pile at once.

New brasses are put in the connecting rod. The old ones are saved when they should go into brass scrap pile at once. No man ever saw an old pair of rod brasses which could be used for anything but scrap.

A key in the connecting rod is found to be slack sideways, and a new one is made.

The old one is no good, and should go in wrought iron scrap pile. It is generally saved for years.

Old pipe elbows, and unions, and tees, and crosses get stripped and are far worse than useless. They should be buried far from the sight of man, but in fact they are very carefully saved. If an inch elbow is found defective it is not put in the common pile of inch elbows, but is carefully put in with the inch-and-a-quarter elbows. A pulley cracked in one arm or in the rim is condemned as unfit for use, but it is saved for some unwise purpose. An old gear is saved for years when it is well known that no gear can be cast to match it. A single bevel wheel is saved for years when it is notorious that a pair of bevels, let alone an odd one, never comes into play. I have seen shops always and eternally short of scrap iron when the shop was completely lumbered up with it. Old steam cylinders, replaced because they are worthless, are treasured for years. What's the use of it?

* * * * This practice of littering the shop up with useless scrap is not confined to rough-and-tumble shops in the country. The finest tool and locomotive shops sometimes take the disease, and if it is not checked it will invariably prove fatal. Parts of machines which are found defective will always be useless and are not worth a day's shop-room. Tons of such stuff can be found in many fine shops. Damaged tools are steel scrap and nothing else. They have no proper place as items in an account of stock.

* * * * Another tip-top thing to melt up is an old lathe, or planer, or drill press. It is not a good plan to save such tools in remembrance of the good they have done.

Many a shop starts up with good fresh tools adapted to do the work of the age. Time runs on; lots of good work is done; lots of money is made; and the tools are wearing out.

New and enterprising builders succeed in changing the character of popular demand, and the old shops often find that, in spite of a splendid past record, their products won't suit the buyers of to-day. They condemn this new generation of buyers, and finally in self-defense are compelled to change the style of their products to suit the unreasonable demand, and then they find that their ancient tools, while well adapted to the ancient product, are totally inadequate to the new requirements.

* * * * I say they find such to be the case, but I doubt the general correctness of the statement. They only find that the trade seems to have absorbed new tricks which they fail to get hold of. They are proud of their old skill, and look upon a lathe as a lathe, and a planer as a planer, and having lots of them they don't see through things. The competitive price list bothers them, and they gradually fall into the belief that the new race of machine men conduct business on a reckless and unjustifiable basis.

* * * * A lathe is a standard staple machine, always designed for the same general range of work, but at the same time the ancient lathe is a much different tool from a modern one. A modern lathe too much played out cannot do the work of a lathe in good shape. Old tools tend to make old workmen out of new men, not in skill but in habit.

* * * * When a boy starts at the trade he buys a four-inch scale or rule and carries it in his pocket. In five years' time he gets much good out of this nice little tool, but gradually and surely it is playing out. The corners get rounded off, it gets red rust on it and he wipes it off; it gets black rust on it and he polishes it off. This trick soon gets away with the lines and figures. He still sticks to this old scale, and his other little tools will be treated in the same manner. If a scale be used up it is not as good as a good one. If the end of a scale be squared off on a grindstone to bring the corners up square, it is not as good as a good one. If a scale be used for blocking in the tool post, or under planer jobs, it will not long stay as good as a good one.

* * * * Now the honest fact is, and few workmen seem to find it out, that a four-inch scale and all such tools are articles of consumption. They should be replaced with new ones as soon as their decay becomes well set in. A four-inch scale should not be kept out of use to make it last longer, and it should not be kept in use after its time is out. Such a tool should be thrown away every six months and a new one got in its place. The expense of such renewals is the merest trifle, and it is well justified by the fact that it lets one use good tools and use them plentifully.

* * * * This principle holds good with lathes as well as with scales. Other things being equal, the new shop with new tools will generally scoop the old shop with old tools; and, other things being equal, the old shop which is prompt in getting new tools will generally scoop the old shop which thinks it can get along with tools whose good record belongs to past ages.

There is a time to invest good dollars in good machine tools, and there is a proper time to throw these same tools into the scrap pile and make good castings of them. It don't pay to belt them up in some corner and use them for special work. It don't pay to make bolt cutters, or horizontal drilling machines, or polishing machines out of them. They should be got out of the shop entirely. Their very existence on the premises exerts a bad influence, which is simply one element in a concomitant system.

* * * * Yours respectfully,

CHORDAL.

Rumors are afloat that a Persian will shortly establish at Durham, N.C., a factory for the manufacture of silk.

Hercules Wheel 33 in. Diam. Nov. 12 1879.
Per cent. of Water used

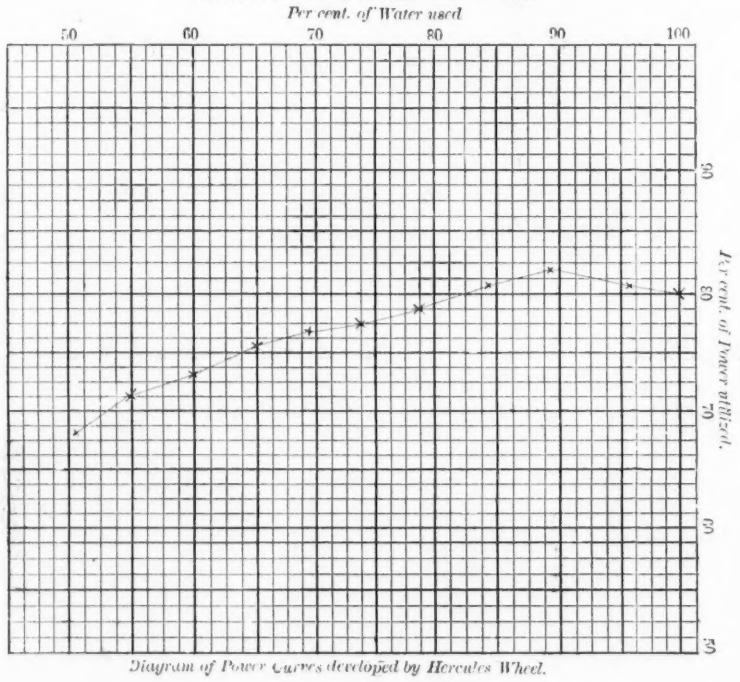


Diagram of Power Curves developed by Hercules Wheel.

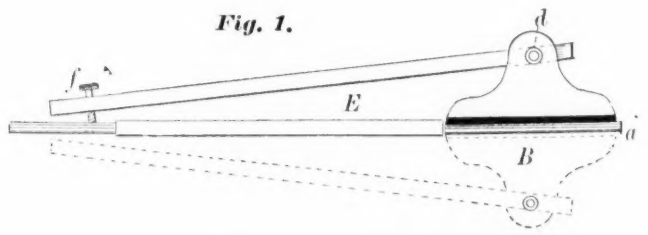
Exhibitors at the Melbourne International Exhibition.

We are indebted to Mr. T. R. Pickering, United States Commissioner to the Melbourne International Exhibition for the following list of exhibitors from the United States. In adddition to these will probably be as many more exhibitors from this country who will transfer their exhibits from Sydney to Melbourne. At the Sydney International Exhibition which closed some weeks ago over 200 awards were made to American exhibitors. The legislature of Connecticut made a special appropriation to aid the display of productions from that state:

Wm. R. Warner & Co., Philadelphia, Pa., pharmaceutical products.
Wamsutta Mills, New Bedford, Mass., cotton goods.
H. D. Justi, Philadelphia, Pa., artificial teeth.
Moore Combination Desk Co., Indianapolis, Ind., desks.
Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn., fire arms.
Volney W. Mason & Co., Providence, R. I., friction clutch pulley.
Page Belting Co., Concord, N. H., leather belting.
Thomas C. Williams & Co., Richmond, Va., tobacco.
C. L. Hathaway & Sons, Boston, Mass., leather dressings.
Oliver Ames & Sons, North Easton, Mass., agricultural implements.
J. H. Hobbs, Brockunier & Co., Wheeling, W. Va., glassware.
The Smith American Organ Co., Boston, Mass., reed organs.
Collins & Co., Hartford, Conn., agricultural implements.
Stewart & Hartshorn, N. Y. City, window fixtures.
Yale Lock Manufacturing Co., Stamford, Conn., hardware, bronzes, &c.
Carter, Dinsmore & Co., Boston, Mass., inks.
Williams Brothers, Ithaca, N. Y., portable engines, &c.
The M'Cormick Harvesting Machine Co., Chicago, Ill, reaping and mowing machines.
Eagle Lock Co., Terryville, Conn., hardware and machines.
Valentine & Co., N. Y. City, varnishes.
Albert P. Dickey, Racine, Wis., fanning mills.
J. Estey & Co., Brattleboro, Vt., reed organs.
Everett & Small, Boston, Mass., harrows.
Hy. W. Peabody & Co., Boston, Mass., agricultural implements.
Bagnall & Loud, Boston, Mass., blocks, etc.
Wakefield Rattan Co., Boston, Mass., rattan seating.
Hoopes Bro. & Darlington, West Chester, Pa., hubs, spokes, &c.
Walter A. Wood, Hoosick Falls, N. Y., reapers and mowers.
Wm. H. Winship, Boston, Mass., trunks, &c.
Perkins Institute for the Blind, South Boston, Mass., improved books.
T. W. Bicknell, Boston, Mass., *Journal of Education*.
American Watch Co., Waltham, Mass., watches, &c.
Seabury & Johnson, N. Y. City, surgical instruments.
F. S. Pease, Buffalo, N. Y., lubricating oils, &c.
Johnston Harvester Co., Brockport, N. Y., agricultural implements.
Leo Schlesinger & Co., N. Y. City, mechanical toys.
J. & L. F. Kuntz, N. Y. City, lager beer.
Morris, Wheeler & Co., Philadelphia, Pa., nails, spikes, &c.
J. W. Daughaday, Philadelphia, Pa., printing presses.
Anthony Pirz, Long Island City, chemical products.
Theodore Gubelman, Jersey City, photographic portraits.
Russell & Erwin Manufacturing Company, New Britain, Conn., hardware and mechanics' tools.
McKellar, Smith & Jordan, Philadelphia, Pa., type foundry products.
Johnson, Clark & Co., New York City, sewing machines.
Fairbanks & Co., St. Johnsbury, Vt., scales, weighing machines.
Stanley Rule and Level Co., New Britain, Conn., implements and carpenters' tools.
Globe Nail Co., Boston, Mass., horse nails.
C. W. Page & Son, New York City, oars, sculls and sweeps.
C. S. Osborne & Co., Newark, N. J., harness makers' tools.
S. S. White, Estate of, Philadelphia, Pa., dental manufactures.
A. Whitney & Sons, Philadelphia, Pa., chilled cast wheels for railways.
Mrs. Marion Derby, Jersey City, N. J., fruit and vegetable preserving process.
Edward Miller & Co., Meriden, Conn., hardware, &c.
Frazer Lubricator Company, New York City, Frazer axle grease.
Frank Miller & Sons, N. Y. City, leather dressing, &c.
Silver Lake Co., Boston, Mass., steam packing, &c.
Wellington Bros. & Co., agents, Boston, Mass., steam packing, &c.
Wheeler & Wilson Mfg. Co., Bridgeport, Conn., sewing machines.
L. Prang & Co., Boston, Mass., art publications.
Barclay & Co., N. Y. City, toilet preparations, &c.
Chadborn & Coldwell Mfg. Co., Newburgh, N. Y., lawn mowers.
DeGrauw, Aymar & Co., N. Y. City, oars and handspikes.

Hy. H. Shufeldt & Co., Chicago, Ill , alcohol and refined spirits.
Dunbar, Hobart & Whidden, South Abington Sta., Mass., nails.
Allen & Ginter, Richmond, Va., tobacco.
D. M. Osborne & Co., Auburn, N. Y., agricultural implements.
Robt. Finland, South Boston, Mass., mfr. of toilet soaps.
A. Field & Sons, Taunton, Mass., tacks and nails.
Simpson, Hall, Miller & Co., Wallingford, Ct., electro-plated ware.
Lalance & Grosjean Mfg. Co., N. Y. City, seamless metal goods.
John Gibson's Son & Co., Philadelphia, Pa., whiskies.
A. S. Hale, Lyons, N. Y., oil of peppermint.
Jno. A. Lowell & Co., Boston, Mass., dry process printing from steel plates.
Alex. Graham Bell, Washington, D. C., telephonic apparatus
Wm. S. Kimball & Co., Rochester, N. Y., Vanity Fair tobacco.
Bevin Bros'. Mfg. Co., East Hampton, Ct , bells.
Oregon Packing Co., Portland, Oregon, Columbia River salmon.
Putnam Nail Co , Neponset, Mass., horse shoe nails.
Simpson, McIntire & Co., Boston, Mass., canned butter.
Messer & Higgins, Boston, Mass., ornamental wood work.
Scott Paper Co., Limited, Philadelphia, Pa., papoleum floor coverings, &c.
Philadelphia College of Pharmacy, Phila., Pa., North American drugs.
Jno. Randolph & English, Richmond, Va., fancy paper boxes.
W. H. Bowdlear & Co., Boston, Mass., white beeswax.
Wm. L. Coon, Wakefield, Mass., working model of steam engine..
Providence Tool Co., Providence, R. I. military and sporting rifles.
The Douglas Axe Mfg. Co., Boston, Mass., axes and edge tools.
Taylor & Farley Organ Co., Worcester, Mass., cabinet organs.
The J. M. Brunswick & Balke Co., N. Y. City, billiard tables.
Thos. Gill, N. Y. City, borax soaps.
The Morse Twist Drill and Machine Co., New Bedford, Mass., taps, dies, drills, reamers, &c.
Watt & Call, Richmond, Va , plows.
Mrs. Wm. P. Brown, N.Y. City, ornamental needle work.
The Weston Electric Light Co., N. Y. City, machines and lamps for lighting by electricity.
Condit, Hanson & Van Winkle, Newark, N. J., Weston electro-plating machines, &c.
Gardner & Co., N. Y. City, perforated vencer seats, chairs, &c.
The Davis Sewing Machine Co., Watertown, N. Y., sewing machines.
Joseph Burnett & Co , Boston, Mass., cologne extracts, etc.
Golding & Co., Boston, Mass., printing presses.
M. F. Whiton & Co., Boston, Mass., cotton duck and cordage.
Dodds & Jackson, Dayton, Ohio, K. Davis lawn rakes.
Geo. Merryweather, N. Y. City, 3 medals relating to Captain Jas. Cook.
Hancock Inspirator Co , Boston, Mass., "The Hancock Inspirator."
Hiram Holt & Co., East Wilton, Mass., hay knife.
Smith & Wesson, Springfield, Mass., revolvers.
Higganum Mfg. Co., Higganum, Ct., agricultural implements.
Kewanee Mfg. Co., N. Y. City, windmills.
Winchester Repeating Arms Co., New Haven, Ct., fire arms.
Henry Barnard, Hartford, Ct., educational publications.
Rowley & Hermance, Williamsport, Pa., band saw, sand papering machine planer and matcher, etc.
Wm. A. Ives, New Haven, Ct., boring implements.
Wilcox & Gibbs, New York City, sewing machines.
Juvet & Co., Canajoharie, N. Y., time globe.
H. O. Buck & Co., W. Stafford, Ct., military and sporting rifles.
The Oswego Starch Factory, Oswego, N.Y., starch.
G. Westinghouse & Co., Schenectady, N.Y., grain threshing machines.
Geo. Bechtel, Staten Island, N. Y., bottled lager beer.
Herring & Co., N. Y. City, fire-proof safes, etc.
M. Poeschel, Scherer & Co., Hermann, Mo., wines.
The Puzzoline Co., Boston, Mass., glue, cement, etc.
Harris & Co, Boston, Mass., weather vanes.
Enterprise Manufacturing Co., Philadelphia, Pa., general hardware.
Forbes' Lithograph Manufacturing Co., Boston, Mass., alberttype, engraving, etc.
The Pope Manufacturing Co., Boston, Mass., the Columbian bicycle.
Frick & Co., Waynesboro, Pa., Eclipse farm engine.
Woven Wire Mattress Co., Hartford, Ct., iron bedstead with wire mattress combined.
John Rogers, N. Y. City, statuettes.
The Vermont Merino Sheep Breeders' Association, Middlebury, Vt., wool.
United States Cartridge Co., Lowell, Mass., metallic ammunition for fire arms.
Bradley & Hubbard Manufacturing Company, W. Meriden, clocks.
Henry Barnard, Hartford, educational works.
O. B. North & Co., New Haven, saddlery hardware.
New Haven Staple Co., New Haven, wrought iron staples.
Winsted Manufacturing Co., Winsted, scythes and hay knives.
C. Cowles & Co., New Haven, carriage hardware.
New Haven Wheel Co., New Haven, wagon and carriage wheels.
Peck Brothers & Co., New Haven, plumbers goods.
C. Pierpont, New Haven, agricultural implements.
New Haven Fish Hook Co., New Haven, fish hooks.
Eagle Co., New Haven, scythes.
L. Candee & Co., New Haven, rubber goods.
New Haven Ruffle Co., New Haven, ruffling.
Middletown Plate Co., Middletown, silver plated ware.
Bevin Brothers Manufacturing Co., Easthampton, bells.
Ives & Miller, axes.
Meriden Flint Glass Works, Meriden, glass.
Rogers Bros., Waterbury, plated table ware.
Benedict & Burnham Manufacturing Co., Waterbury, cheap watches.

Fig. 1.



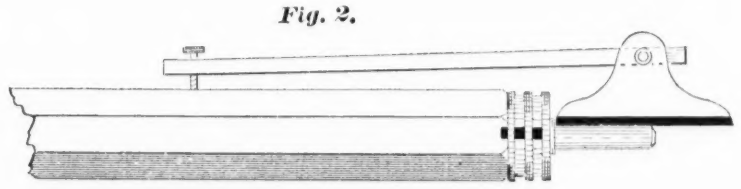
Geo. Bruce's Son & Co., New York City, specimen book of printing types.
Ansonia Clock Co., New York City, clocks.
J. S. Leaming, Wilmington, Ohio, sample of maize.
Milton Bradley & Co., Springfield, Mass., games and toys.
San Jose Fruit Packing Co., San Jose, Cal., canned goods.
Amer. Twist Drill Co., Meredithville, N. H., automatic knife grinder. Emery grinder No. 3.
The New York Plow Co., New York City, lawn mower and corn sheller.

Straightening Journals and Setti ng Wing or Other Kinds of Gudgeons in Wooden Shafts.

BY A. FORREST.

The accompanying drawing represents a simple, costless device which I have used, practically, in my business for so many years that I do not remember whether the idea was original with me or not, and I don't see as it makes any difference in its utility. It is employed in straightening bent journals of shafts, and setting gudgeons in rolls and

Fig. 2.



Empire Portable Forge Co., Cohoes, N. Y., portable fan blowing forges.
Rollo Munsell & Co., New York City, stoves for cooking purposes.
A. Musselman & Son, Quakertown, Pa., spokes and handles.
Lawson & Brenizer, Philadelphia, Pa., hay and manure forks.
Stephen Ballard & Co., New York City, leather belting.
Henry Disston & Sons, Philadelphia, Pa., saws.

CONNECTICUT COLLECTIVE EXHIBIT.

W. J. Carnes Sr., New Britain, patent seamless harness buckle.
Waterbury Button Co., Waterbury, buttons.
Andrew B. Hendeys & Co., New Haven, bird cages.
U. S. Stamping Co., Portland, sheet metal stamped goods.
Mayer, Strouse & Co., New Haven, corsets.
Wm. A. Ives, New Haven, wood boring tools.
Parker Brothers, Meriden, guns.
Victor Sewing Machine Co., Middletown, micrometer calipers and chucks.
W. & B. Douglas, Middletown, pumps.
The E. Horton & Son Company, Windsor Locks, chucks for lathes, &c.
Colts Patent Fire Arms Manufacturing Co., Hartford, engines and arms.
Manning, Bowman & Co., W. Meriden, nickel and silver plated ware.

wooden shafts. In Fig. 1, *E* represents an iron shaft with one of its journals deflected from the true axial line. The device by which the journal may be corrected consists, essentially, of the metal plate *B*, of form shown; its long side or edge being perfectly straight. This is provided with a pivotal clutch bolt, and thumb nut *d*, by which the plate is attached to the simple bar of wood *C*, and by which it may be clamped in any desired position. It will be readily seen that by placing the instrument as shown in Fig. 1, with the straight edge of the plate in contact with the journal, and clamping it in that position, and then carrying it to the opposite side, as shown by the dotted form, the *departure* at *a*, will equal twice the deflexure of the journal to be corrected.

The process of correcting is continued until the straight edge of the plate, when brought in contact with one side of the journal, will equally coincide with it in any position; the journal will be in the true axial line.

If the opposite journal should prove to be deflected, it may be corrected by the same process. The bar *C*, being of wood, may readily be extemporized of any length required in special cases. If the plate *B*, is made of metal about $\frac{3}{64}$ of an inch in thickness, and the edge beveled on one side, it will give greater satisfaction in use.

The most useful purpose for which this simple tool may be used is in setting gudgeons in wooden shafts or rollers. Fig. 2 shows the instrument as applied to such purpose, and its adaptability needs no further explanation. This tool will be found to be a great improvement on the usual system of straight edges and "squinting." For all practical uses, a nail driven into the bar at *f*, will answer the purpose.

Letters from Practical Men.

BRACING BOILERS.

Editor American Machinist:

Your paper of the date of Dec. 6th, 1879, contained an article with excellent illustrations of the locomotive "Lehigh" by your able mechanical engineer, Mr. L. F. Lyne.

The cause of the accident seemed apparent to me; and I published an article with a rough sketch, suggesting some improvements in locomotive boiler construction, in the MACHINIST of Dec. 20th. My ideas were fully indorsed, later, in the MACHINIST, by Mr. Henry Schaubel, superintendent of Neafie & Levy's boiler shops of Philadelphia. (See MACHINIST of Jan. 31st, 1880.) In the issue of March 6th, Mr. W. H. Thompson, of Cleveland, O., gave Mr. Schaubel and your humble servant a "sharp rap" on boiler bracing, which I am sure was duly appreciated and enjoyed by the writer, and from what I hear of Mr. Schaubel, I am satisfied that he received his share of the intellectual flogging good naturedly. The MACHINIST of the 12th inst. contains another article from Mr. Thompson, accompanied by a sketch. Mr. Thompson complains of the crown strains, due to expansions and contractions causing the outside shell to bend and break, but he failed to show the T iron rafters under shell, plainly shown by Mr. Schaubel and the writer, which add sufficient strength to the shell to prevent any trouble from the cause indicated by Mr. Thompson.

The papers recently read before the Master Mechanics' Association, parts of which have been published in the MACHINIST, have confirmed my previous conclusions, viz.: that crown bars are all wrong, and late reports in mechanical papers from abroad, record verdicts decidedly against the use of crown bars, and state that they are being universally abandoned.

I think our American engineers are very well informed as to the troubles arising from the crowding of ponderous crown bars into the already limited water space over the crown sheet, and I know that at this moment some of our best railway engineers are designing other methods of bracing, with a view to the final abandonment of the *scrap heap* now in use.

I appeal to our friend Thompson to turn *his* attention towards devising some substantial method of holding up the crown sheet without the use of crown bars.

WM. H. HOFFMAN.

Passaic, N. J., June 7th, 1880.

The Reading Hardware Co. propose to move their works to Robesonia, Pa. The object of the removal is said to be to more successfully resist the demands of their workmen for higher wages. They are to put up tenements for their workmen.

Skilled workmen in Saginaw, Mich, are scarce. The proprietor of a planing-mill finds it difficult to get a sufficient number, and recently went to Detroit and offered men $2.25 per day, but found none willing to leave their own city, although there they are paid but $1.62½ per day.

There were 54 cotton factories in North Carolina at the close of 1879, and twenty additional ones will be put in operation this year. These mills are all doing well and making large profits. Under the slave system but little attention was paid to manufacturing, and the staple articles were alone grown by the large planters.

The United Pipe line is investing a million in tankage for 2,700,000 barrels of oil.

Open Blow Lever Safety Valve.

BY W. BARNET LE VAN.

The subject of safety valves is wholly embraced in the static branch of mechanics, because it treats only of forces in equilibrium. The dynamic branch of mechanics treats of forces in motion, producing *power* and *work*.

Statics is the science of forces in equilibrium or at rest; strickly speaking the word refers to forces in regard to solids.

In the common lever safety valve, the lever is of the third order, where the force is between the weight and the fulcrum, and it is evident that the forces will not balance, if they are equal, since they act at different points of the lever.

The illustration shown herewith is a lever of the third kind, representing a safety valve for a steam boiler.

Reference being had to the illustration, the letters denote as follows:

D represents the diameter of the valve v, at its smallest point of contact with the chamber.

W represents the weight acting on the long lever L; also the weight of the lever arm a, valve v, and stem s, acting on the lever x.

L represents the long lever, and is the distance from the center of the weight W, to the fulcrum f, on which the lever arm a, rests.

l represents the short lever, and is the distance from the center of the valve stem s, to the fulcrum f.

x represents the distance from center of gravity g, to fulcrum f.

f represents the fulcrum, and is the support on which the lever arm a, rests.

a represents the lever arm, on which is placed the weight W, and to which is attached the valve stem s.

v represents the valve.

s represents the valve stem or guide.

g represents the center of gravity of the lever arm a, valve v, and stem s.

p will represent the steam pressure above that of atmosphere (as shown by the steam gauge).

A will represent the area of the valve v, and is the square of the diameter D, multiplied by the decimal 0.7854, $(0.7854 \times D^2)$.

From the above illustration it will be seen that there are three forces:

1st. The weight W, acting on the long lever L.

2nd. The weight of the lever arm a, valve v, and stem or guide s, acting on lever x.

3rd. The force due to the pressure p, of the steam per square inch multiplied by the area A, of the valve v, in square inches, acting on the short lever l.

It will be seen from the above that the weights act at two different points, and that there are three levers to be considered.

1st. The long lever L, of the weight W, which is the distance from the weight W, to the fulcrum f.

2nd. The lever x, due to the weight w, of the lever arm a, valve v, and stem s, which is the distance from the center of gravity g, to the fulcrum s.

3d. The short lever l, which is the distance from the fulcrum f, to center of valve stem s.

The center of gravity g, of the lever arm a, is found by balancing it over a sharp edge, with the valve v, and stem s, attached at the proper distance e, from the fulcrum f. The weight w, of the lever arm a, valve v, and stem s, multiplied by the distance x, from center of gravity g, to fulcrum f, gives the *momentum* of the lever arm a, which is a constant quantity in the graduations of the lever arm a, for different pressures of steam.

The form of the lever arm a, affects the location of the center of gravity g, but when this center is known, the shape of the lever arm a does not affect the static momentums. The area and weight can be expressed in any unit of weight, as well as the levers in any unit of length.

For greater accuracy the center of the fulcrum s, weight W, and valve stem s, connection to lever arm a, should be in straight and horizontal lines. And in finding the center of gravity g, the valve v, and stem s, must be in their natural position when the lever arm a, is balanced over a sharp edge in order to find the center of gravity of the system.

The action of the combination is readily understood by the illustration, namely, that the two static momentums, weight w, multiplied by the long lever L, added to the *momentum* $w\,x$, of the lever arm a, valve v, and stem s, multiplied by the distance x, from center of gravity g, to fulcrum f, act opposite and must be equal to the momentum of the force of the steam pressure p, multipled by the area A, of the valve v, and this product by the length of the short lever l, or the static momentums.

The algebraical expression of the foregoing may be set up as follows:

$$W\,L + w\,x = A\,p\,e.$$

Rule in words:

The weight W, multiplied by the length of the long lever L, plus the weight w, of the lever arm a, valve v, and spindle s, multiplied by the distance x, from the fulcrum f, to center of gravity g, or the *momentum* $w\,x$, of lever arm a, equals the area A, of the valve v, multiplied by the steam pressure p, per square inch, and this product by the length of the short lever e.

That is to say, the static *momentums* are in equilibrium.

To find the weight W, on a given safety-valve, pressure p, area A, of the valve v,

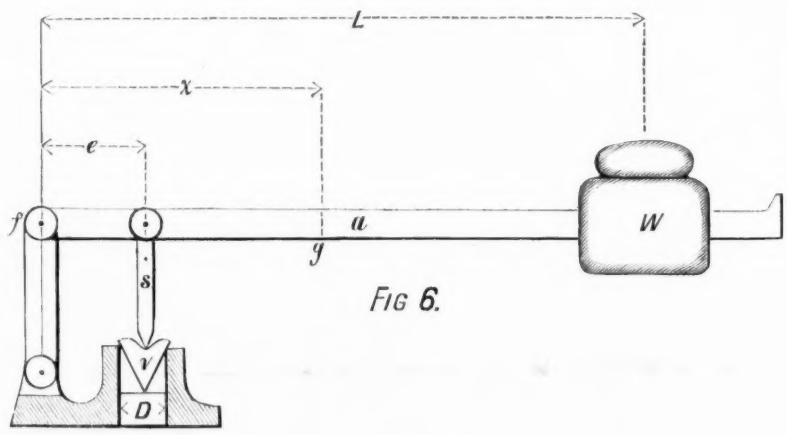


FIG 6.

length of short lever e, weight of lever arm a, valve v, and spindle or stem s, distance x, of center of gravity g, from fulcrum f, and length of long lever L, being given.

$$\text{Weight } W = \frac{A\,p\,e - w\,x}{L} \qquad 2$$

Rule in words:

Multiply the Area A, of the valve in square inches by the steam pressure p, in pounds per square inch, and this product by the length of the short lever l, in inches; from this last product subtract the momentum $w\,x$, of the lever arm a, valve v, and stem s, multiplied by its distance x, from the center of gravity g, to the fulcrum f, divide this remainder by the length of the long lever L; the quotient will be the weight W, in pounds required.

To find the length of the long lever L, the area A, of the valve the steam pressure p, length of short lever l, weight w, of the lever and its distance x, and the weight W, being given.

$$\text{Lever } L = \frac{A\,p\,e - w\,x}{W} \qquad 3$$

Rule in words:

Multiply the area A, of the valve in square inches by the steam pressure p, in pounds per square inch, and this product by the length of the short lever l, in inches from this last product subtract the momentum of the lever arm a, valve v, and stem s, and divide this remainder by the weight W, in pounds; the quotient will be the distance in inches from fulcrum f, to place the weight W.

To find the pressure p per square inch that a safety valve will blow off at, the weight W, length of long lever L, the weight of lever arm a, valve v, and stem s, distance x, of center of gravity g, area A, and length of short lever l.

$$\text{Pressure } p = \frac{W\,L + W\,X}{A\,l} \qquad 4$$

Rule in words:

Multiply the weight W, in pounds, by the length of the long lever $W\,L$, in inches, to which product add the momentum $w\,x$, of the lever arm a, and valve v, and stem s, and divide this sum by the product of the area A, of the valve in square inches, multiplied by the length of the short lever l, in inches, and this quotient will be the steam pressure p, in pounds per square inches.

To find the arc $a\,A$, in square inches, the weight W, length of long lever L, momentum of lever, arm a, valve v, and stem s, length of short lever l, and the steam prsesure p, per square inch being given.

$$\text{Area } A = \frac{W\,L + w\,x}{p\,l} \qquad 5$$

Rule in words:

Multiply the weight W, in pounds, by the length of the long lever L, in inches, to this product add the momemtum $w\,x$, of the lever arm a, (weight w, of lever, arm a, valve v, and stem s, multiplied by the distance x, from center of gravity g, to fulcrum f,) and divide this sum by the product of the steam pressure p, in square inches, multiplied by the length of the short lever l, in inches, and this quotient will be the area A, in square inches.

To find the weight w, of the lever arm a, valve v, and stem s, the area A, of the valve in square inches steam pressure p, length of short lever l, in inches, weight W, in pounds, length of long lever L, in inches, and the distance x, in inches, from center of gravity g, to fulcrum f, being given.

$$\text{Weight of lever } w = \frac{A\,p\,e - W\,L}{x} \qquad 6$$

Rule in words:

Multiply the area A, of the valve in square inches by the steam pressure p, in pounds per square inch, and this product by the length of short lever l, from this last product subtract the product of the weight W, in pounds, multiplied by the length of the long lever L, in inches, and divide this remainder by the distance x, of the center of gravity g, to fulcrum f.

To find the distance x, in inches from center of gravity g, to fulcrum f, the area A, in square inches of the valve, the steam pressure p, in pounds per square inch, the short lever l, the weight W, in pounds, the length of the long lever L, in inches, and the weight w, of the lever arm a, valve v, and stem s, in pounds being given.

$$\text{Distance } x = \frac{A\,p\,e - W\,L}{w} \qquad 7$$

Rule in words:

Multiply the area A, of the valve in square inches by the steam pressure p, in pounds per square inch, and this product by the length of the short lever l, in inches; from this last product subtract the product of the weight W, in pounds, multiplied by the length of the long lever L, in inches, and divide this remainder by the weight w, of the lever arm a, valve v, and stem s.

Having given the levers L l, and x, the area A (D^2 0.7854), steam pressure p, and the weight w, of the lever L, the weight W, is calculated by formula 2.

Example 2. A safety valve has a diameter of $D=2$ inches, and the lever to carry $p=80$ pounds pressure per square inch, with the following dimensions:

A=area of valve D=2 inches $(2\times2\times0.7854)$=	3.1416
L=long lever, in inches	30.
l=short lever, "	4.
x=distance of center of gravity g, to fulcrum f, in inches	15.
w=weight in pounds of lever, arms a, valve v, and stem s	6.
p=steam pressure per square inch, in pounds	80.

What will be the weight required?

$$\text{Formula 2. } W = \frac{A\,p\,e - w\,x}{L}$$

$$W = \frac{3.1416\times80\times4 - 6\times15}{30} = 30.5 \text{ pounds.}$$

Example 3. Suppose a safety valve to be of the following dimensions, at what distance L, from the fulcrum f, must the weight W, be placed to carry a steam pressure $p=50$ pounds per square inch?

A=area of valve D=3 inches $(3\times3\times0.7854)$	7.068
p=steam pressure per square inch in pounds	50.
l=short lever, in inches	4.
w=weight of lever arm a, valve v, and stem s, in pounds	10.
x=distance of center of gravity g, to fulcrum f, in inches	18.
W=weight in pounds	50.

$$\text{Formula 3. } L = \frac{A\,p\,l - w\,x}{W}$$

$$\text{Lever } L = \frac{7.068\times50\times4 - 10\times18}{50} = 22.6 \text{ in.}$$

Example 4. A safety valve having the following dimensions, at what pressure p, per square inch, will it blow off?

L=length of long lever, in inches	30
l=length of short lever, in inches	3
W=weight in pounds	50
w=weight of lever arm a, valve v, and stem s	12
x=length from fulcrum f, to center of gravity g, in inches	15
A=area of valve in square inches	7

Formula 4. $p = W\,L + w\,x$.

$$\text{Steam pressure } p = \frac{50\times30 + 12\times15}{7\times3} = 80 \text{ lbs.}$$

Example 5. The following dimensions and the steam pressure p, per square inch to be carried, to find the area A, of the valve?

L=length of long lever, in inches	30.
l=length of short lever, in inches	4.
W=weight in pounds	30.
w=weight of lever arm a, valve v, and stem s, in pounds	12.
x=the distance from fulcrum f, to center of gravity g, in inches	10.
p=steam pressure, in pounds, per square inch	40.

$$\text{Formula 5. } A = \frac{W\,L + w\,x}{p\,l}$$

$$\text{Area } A = \frac{30\times30 + 12\times10}{40\times4} = 6.375 \text{ square}$$

inches, or about 27.8 inches in diameter.

Example 6. A safety valve of the following dimensions, to find the weight of the lever arm a, valve v, and stem s, the distance x, from center of gravity g, to fulcrum f, and steam pressure p, in square inches being given?

A=area of valve in square inches	2.
p=steam pressure, in pounds, per square inch	80.
L=length of long lever, in inches	20.
l=length of short lever, in inches	1.5
W=weight in pounds	10.
x=distance from center of gravity to fulcrum f, in inches	10.

$$\text{Formula 6. } w = \frac{A\,p\,l - W\,L}{x}$$

$$\text{Weight } w = \frac{2\times80\times1.5 - 10\times20}{10} = 4 \text{ pounds.}$$

Example 7. A safety valve of known dimensions, given to find the distance x, from center of gravity g, to fulcrum f, in inches?

A=area of valve, in square inches	20
p=steam pressure, in pounds, per square inch	30.
L=length of long lever, in inches	40.
l=length of short lever, in inches	4.

W=weight in pounds ..... 50.
w=weight of lever arm a, valve v, and stem s, in pounds..... 20.

Formula 7. $x=\frac{A\,p\,l-W\,L}{w}$

Distance $x=\frac{20\times30\times4-50\times40}{20}=20$ inches.

THE GRADUATION OF SAFETY VALVE LEVERS.

For great accuracy in finding the center of gravity the weight of the valve v, and stem s, should be weighed with the lever arm a, and they also should be placed on the lever at their proper distance from fulcrum f, when the lever arm a, is balanced over a sharp edge. As before stated the *momentum* wx, of the lever is found by multiplying the weight of lever arm a, valve v, and stem s, by the distance x, from the fulcrum f, to the center of gravity g, which is a constant quantity in the graduation of the lever for different pressures of steam.

Example 8. A safety valve of the following dimensions, the lever to be graduated from 30 to 80 pounds to the square inch.

First find the weight W, required for a steam pressure of 80 pounds to the square inch, which number is to be marked on the lever 30 inches from fulcrum f,

A=area of valve in square inches..... 3.
p=steam pressure in pounds per square inch.....80.
L=length of long lever in inches.....30.
l=length of short lever in inches..... 2.
w=weight of lever arm a, valve v, and stem s, in pounds..... 4.
x=distance from fulcrum f, to center of gravity g, in inches..... 7.5

Formula 2. $W=\frac{A\,p\,l-u\,x}{L}$

Weight $=\frac{3\times80\times2-4\times7.5}{30}=15$ pounds

The weight required to balance p=80 pounds per square inch placed on the lever L,= 30 inches from fulcrum f.

Now find the long lever L, or at what distance from the fulcrum f, shall the weight $W=15$ pounds be placed to balance a steam pressure of $p=30$ pounds to the square inch

Formula 3. $L=\frac{A\,p\,l-u\,x}{W}$

Distance from fulcrum f,—

$L=\frac{3\times30\times2-4\times7.5}{15}=10$ inches.

Then measure off this distance L=10 inches on the lecer arm a, from the fulcrum f, and mark it with the number 30. Divide the distance between the first and second position of the weight into 80—30=50 equal parts, and number them from 30 to 80. The lever is thus graduated for the required pressure of steam, by one pound of difference per square inch.

Small Compound Engines.

On this page is shown an engraving of a pair of small compound marine engines, recently constructed by Ross & Duncan of Glasgow, Scotland, for the steamship Allan Macdonell. These engines are of a type, says *Engineering*, which has now become a favorite one for small powers in the Clyde district. The particular engines illustrated are rated at 25 H. P. nominal.

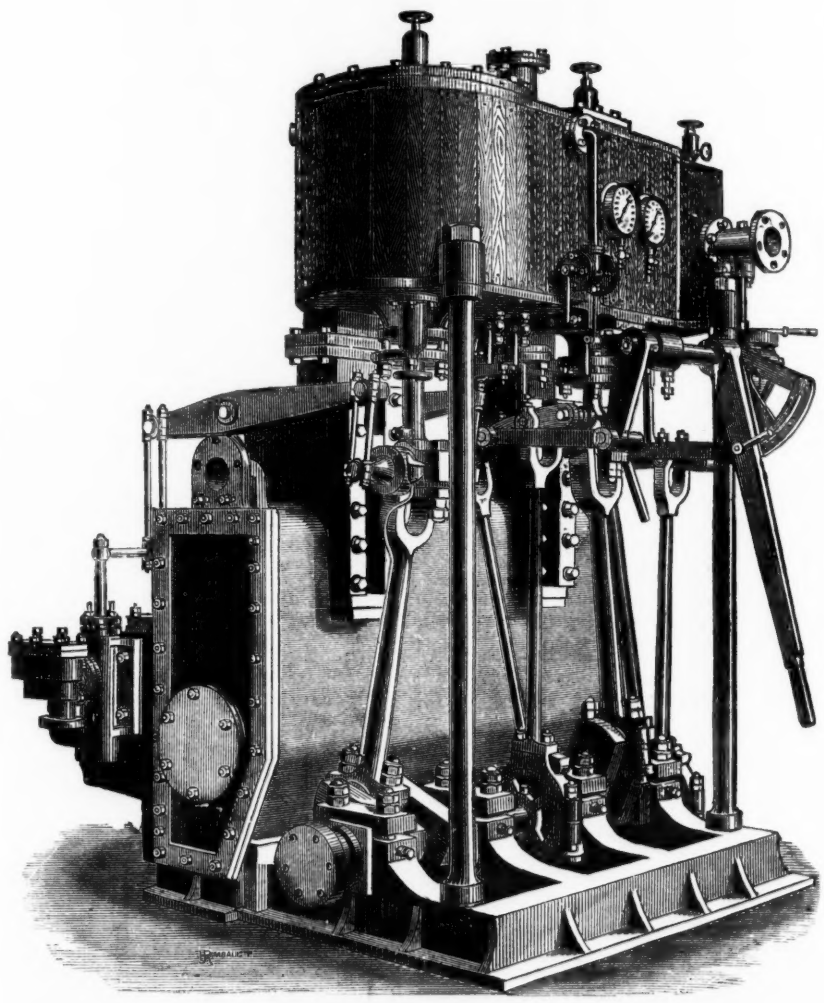
The high-pressure cylinder is 13 in. in diameter, and the low-pressure cylinder 23½ in. in diameter, while the stroke of both pistons is 18 in. The surface condenser forms the base of the back columns, being cast in a piece with them. It has a large cooling surface of solid drawn brass tubes ¾ in in diameter.

The air, circulating, feed, and bilge pumps are worked by rocking levers from the cross-head of the low-pressure engine. The reversing gear consists of link-motion, and being of a size easily handled is worked direct by a hand lever. The general design of the engine is compact and substantial, and such as to admit ready access to all the parts. All the rods are polished and have brass bushed joints easily adjustable.

Steam is supplied by a high-pressure cylindrical boiler with two furnaces and return tubes. The total length required for engine and boiler space is about 23 feet. This class of engine, continues *Engineering*, is altogether superseding the high-pressure non-condensing and the low-pressure condensing engines, formerly so general in coasting vessels, and of course effects a large saving in coal to the owners.

Turkish Brigands.

It is always a pleasure to note that things are improving in particular departments in any particular part of the world, says the *Detroit Free Press*. It is popularly thought that matters in Turkey, instead of improving, have been going steadily backward for many years past. This is only partly true. Some of Turkey's institutions show great advancement during the last few years. There are her brigands for instance. Several years ago the bands contained only five or ten men, now they go in detachments numbering as many as 150. They then had old flint-lock guns that would not go off on a damp day, and when they did go off were generally more dangerous to the brigand than to the individual he was shooting at; now they are armed with the very best rifles and revolvers made. The ears and noses of their victims are cut off with the finest kind of English cutlery, and torture is inflicted by the latest modern devices. Let those who are fond of decrying Turkey ponder on these facts and admit that the march of improvement goes steadily onward, even in the Sultan's domains.



SMALL PROPELLER ENGINE.

Boiler Proportion and Construction.—Water Tube Boilers—Why the Lower Courses of Tubes Burn Out.

BY WILLIAM H. HOFFMAN.

We will take, for an example, settings for two boilers, each 80 H.P. Between the two side walls, in each case, there will be, we will say, a distance of six feet. In one of the settings we will place a fire tube boiler, 66″ in diameter and 14 feet long. In the other setting we will place a water tube boiler with tubes, say, 5″ in diameter and 12 feet long. In the fire-tube boiler there will be an allowance of ten square feet of heating surface per horse power; and, in the water-tube boiler, we will allow 7½ square feet per horse power. Our fire-tube boiler will have 24 square feet of grate surface, and our water-tube boiler 20 square feet of grate. With a natural draft we *can* burn under the fire-tube boiler 430 lbs. of coal per hour, representing 3,900,000 units of heat. This heat is received at *first* on the shell of the boiler, which contains 144 square feet. Inside of the shell, at its *lower* portion and *sides*, *outside* of the tubes, there are at least 90 cubic feet or 5,625 lbs. of water, and as the evaporation at *this point* is but about 1,900 lbs. per hour, we have a constant surplus to draw from of nearly 60 cubic feet, or 3,725 lbs., or nearly double the hourly evaporation. It is simply impossible to *burn* sheets under these conditions.

We will now consider the case of the water-tube boiler in the other setting. The space between the side walls being six feet, we can get in ten 5″ tubes in the lower row, and eight in the row above this. These eighteen tubes have 288 square feet of heating surface, but only three-fifths of this is effective, or about 175 square feet. In the furnace of this boiler, we *can* burn, with natural draught, 360 lbs. of coal per hour. Inside of these eighteen tubes that receive the fiercest fire from the furnace, *there are but* 24 cubic feet of water, or 1,500 lbs., and this small body of water is exposed to the first contact of 3,240,000 units of heat per hour, while the water consumption at *this point* must be between 1,400 and 1,500 lbs. per hour, leaving little or no surplus. If there were no obstructions to the circulation of the water, by the friction of the water in the tubes, and the passage of the steam and the water in their opposite courses, there probably would be less trouble with water-tube boilers, but, unfortunately, these obstructions are *real*, and as the water cannot reach the lower tubes readily, they must and *do* perish rapidly.

I claim, that in the lower courses of tubes of the modern inclined water-tube boilers, fully twenty-five per cent. of the heating surface is rendered ineffective by the water being driven from the tubes by the intense fire, and not until the third row is reached is the circulation and evaporation as it should be.

It must be remembered that in making these comparisons I have fixed on a *wide* space between walls of furnace, in order to get as many tubes exposed to the fire as possible, to take up the heat on a *large* surface, and thereby save the tubes, but there is not an 80 H.P. water-tube boiler in use to-day that has a distance of six feet between walls. Many of them are no more than three feet, having only twelve 4″ or 4½″ tubes to receive the first contact of the heat from 20 square feet of grate. Is it strange then, I ask the reader, that the builders of water-tube boilers will not guarantee them for more than four years? I think not. They know the metal must fail, and nothing but steel tubes will help them to any extent. I believe the steel tube will prolong the life of a sectional water-tube boiler fifty per cent.

A school of mechanical engineering and kindred subjects has been opened in connection with the Deseret University, Salt Lake City, Utah.

It is stated that the old Boonton, N. J., water power will soon be disposed of to a company which will use it for the manufacture of paper.

An Apt Illustration.

Writing of the difficulty English engineers experienced in making educated Persians understand the working of the electric telegraph, Mr. Mounsey says:—"Much of the time of one of our officers was occupied during several weeks in attempting to enlighten the mind of a provincial governor, who had got it into his head that the wires were hollow tubes, and that messages were transmitted through them, as in the pneumatic post. In vain was the whole apparatus shown to his Highness; in vain even all its parts explained and re-explained—he stuck to his idea; and it was only by the suggestion of the following simile that he was at last induced to relinquish it, and declare himself satisfied. "Imagine," said the officer, "a dog whose tail is here at Teheran, and his muzzle in London; tread on his tail here, and he will bark there."

Steel in Carriage Building.

The substitution of steel for iron has made another step in advance, says the *Engineer and Iron Trades Advertiser*, and in a direction where, if the hopes of the inventors are justified by the result, we may expect to see considerable changes. Hitherto the metal work of our ordinary driving carriages has been wholly iron, except in those instances where the partial introduction of steel took the place of any additional ornament. A well-known metropolitan coach-building firm has now on view the specimen of a carriage built wholly with steel—springs, tire, framework, etc., and it is calculated that the saving in weight will be nearly 25 per cent., with possibly better results in the future; while for supporting wear and tear the preference for steel over iron will, when its advantages are known, be as strongly endorsed by owners of carriages as they are now by directors and managers of railroads.

The pachymeter, an instrument lately patented in Vienna, says the *Paper World*, accurately determines the thickness of paper to the one-thousandth part of an inch. The micrometer caliper, which is coming into use throughout this country, where accurate measurements are desired, will determine the thickness of paper or anything else to the ten-thousandth part of an inch. Another Austrian invention is the dasymeter, a small pendulum which indicates in pounds just the amount of force which is necessary to break a strip of paper stretched between two points by means of a screw, until it can no longer bear the tension.

The cost of the engravings in a single number of either Harper's or Scribner's Magazine, it is said, ranges from $5,000 to $8,000.

Crosby's Steam Engine Indicator.

The tendency to high speed engines having outstripped the capacity of all known devices for registering correctly the pressures exerted upon the piston, rendered it imperative that a more reliable intrument should be made before correct indications could be procured. After considerable study and experiment, Geo. H. Crosby has produced a steam engine indicator which, it is claimed, accomplishes the desired results, and superiority is claimed for this instrument for engines running at any practical speed.

The engraving herewith represents a Crosby indicator, and it will only be necessary to give the following description to enable engineers to readily appreciate the advantages accruing from its use:

A is a case or jacket, enclosing a cylinder, into which a piston is nicely fitted to move without friction. To the upper side of this piston is attached a steel helical spring, the upper end of which is fastened to the cap or head of the cylinder. To the upper rod *B*, is directly jointed the short lever *C, D*, whose short end is jointed to the head of a vibrating standard at *D*, its long end being jointed to the long lever *E, F*, at the point *C*. The long arm of the lever *E, F*, is jointed at its outer extremity to a second vibrating standard at *E*, and to the other extremity is attached the pencil *F*. To the case *A*, is permanently attached the horizontal plate *G*, at one end of which is jointed a corresponding plate *H*, situated above the former and carrying the revolving drum, covered by the paper cylinder *I*. To this drum is attached a cord, wound around a groove at its base and carried by the guide wheel *K*, between the two extra guide wheels *L* and *M*. The guide wheels *L* and *M* are attached to the arm *N*, which swivels around a point in line with the axis of guide wheel *K*, and is held in its proper position by the thumb nut *O*. The drum carrying the paper cylinder *I*, is rotated in one direction by the tension on the cord, and in the reverse direction by the reaction of a spring enclosed therein. The tension upon this spring may be adjusted to suit by the thumb nut at the open end of the drum.

The plate *H*, carrying the drum and paper cylinder, is held away from the pencil *F*, by a spring situated between the plates *H* and *G*, directly in line with the axis of the drum, until the operator desires to take a diagram. By pressing upon the handle *P*, the paper cylinder is moved forward and the pencil comes in contact with the paper. Immediately upon removing this pressure the paper cylinder automatically assumes its former position. Two adjustable stops determine the amount of this motion, and regulate the force with which the pencil presses upon the paper, a hair line being attainable without friction.

The bushing which carries the pencil is bored to receive a graphite or metallic wire, and is supplied with means for holding it in any position desired. The piston rod is bored at each end almost half its length, leaving a thin partition or stop in the center. The upper chamber is used as a reservoir for a lubricant, and is provided with pin holes close to the partition to allow the oil to flow out and down, and so lubricate the rod and piston. The lower chamber allows the steam to enter and warm the lubricant, causing it to assume a more limpid form and flow freely in cold weather. The piston rod is thus made lighter without weakening it materially.

A minute portion of felt placed at the bottom of the reservoir will prevent the oil from flowing too freely. It can be supplied with oil at any time at the upper end of piston rod by using a common pressure oiler with a very small nozzle. The head of the piston rod is provided with a device by which the pencil may be made to assume any desired height.

Removing the guide wheels to the opposite end of the plates *H* and *G*, allows the instrument to be used either right or left handed.

The use of a revolving drum for transmitting motion to the paper having been demonstrated to be the best means for the purpose, it has been adopted.

Among the novelties in this indicator we find the following: A new device for procuring parallel motion without the aid of guiding-slots, or compensating-arm jointed at one end to some rigid point, by which the pencil is caused to travel in a straight line strictly parallel to the motion of the piston. The pencil motion is an exactly uniform multiplication of the piston motion, and the pencil is situated close to the piston rod instead of projecting several inches to one side. Each instrument is provided with mechanism for adjusting it for either right or left hand. The hollow piston rod and the extreme lightness of the levers and piston reduces the force occasioned by the momentum while reciprocating. The self-lubricating contrivance keeps the piston rod, piston and cylinder constantly oiled while in operation, reducing the friction to a minimum, and rendering the piston free from leakage, thus registering even the exact degree of vacuum acting on the piston of condensing engines. Other important features include the moving of the paper up to the pencil, instead of moving the pencil to the paper, and an arrangement for automatically moving the paper away from the pencil after registering. Means are provided for adjusting the distance for the paper to move towards the pencil, so that a hair line is obtained without friction. Means are also provided for adjusting the tension of the spring in the reciprocating drum. A close air chamber or jacket encircles the cylinder instead of an open steam chamber. Steel pivot points are used instead of journals.

CROSBY'S INDICATOR.

This instrument is more easily operated than indicators in which it is necessary to be to some extent an expert, with a delicate sense of touch to determine just the proper force to employ in moving the pencil against the paper, so as not to tear or cause undue friction.

It is claimed that this indicator is free from some very objectionable features prominent in others. Friction always causes errors of registration, but at the same time admits of drawing the diagram even and smooth, and deceives the operator into the belief that he has obtained a good diagram, while the reverse is true.

The manufacturers of the Crosby indicator have aimed by all possible means to avoid friction, reduce the weight of reciprocating parts, correct errors, and simplify the method of operation, and when properly adjusted, connected and operated it is claimed that diagrams made by this instrument may be implicitly relied upon. This indicator is manufactured only by the Crosby Steam Gauge and Valve Company, corner Milk and Batterymarch streets, Boston, Mass. Its patents date September 2, 1879 and June 1, 1880.

The Multiple Port System of Valve Gear.

BY F. G. WOODWARD.

In THE AMERICAN MACHINIST of March 20, page 4, Mr. Smith asks a very pertinent question relative to the many-port idea which was illustrated in the issue of Nov. 8.

No satisfactory answer can be given to the question, except by actual test upon a much larger scale than I have ever seen the system

Fig. 2.

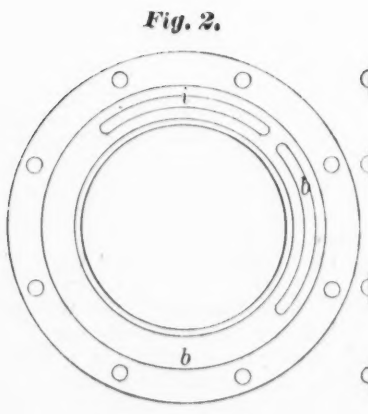


Fig. 1.

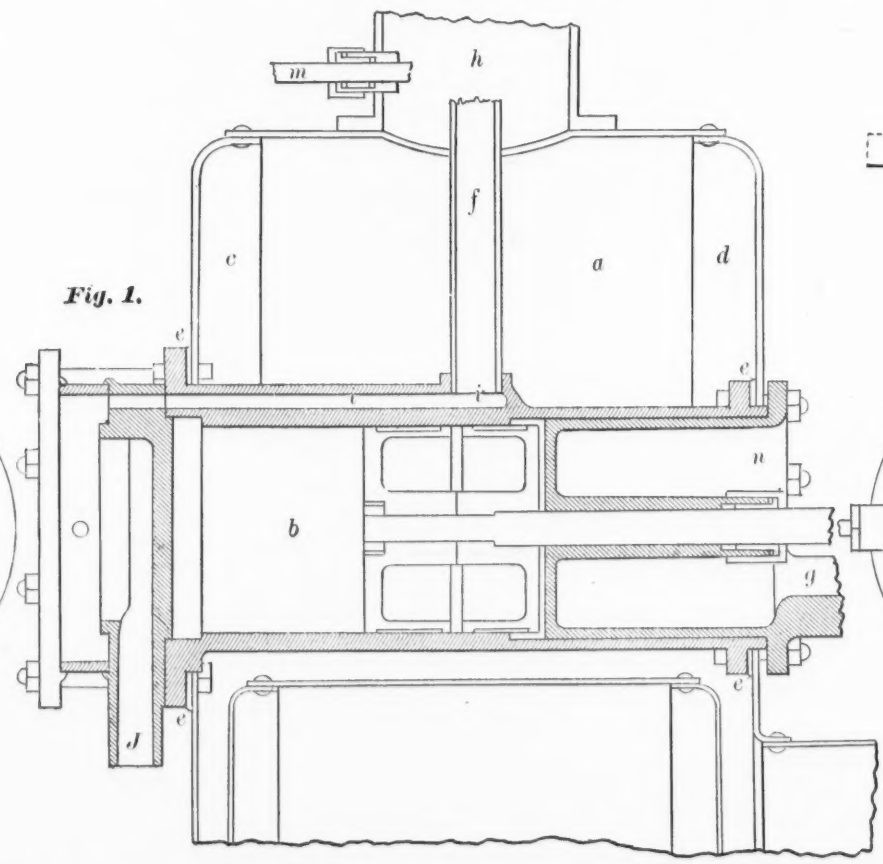
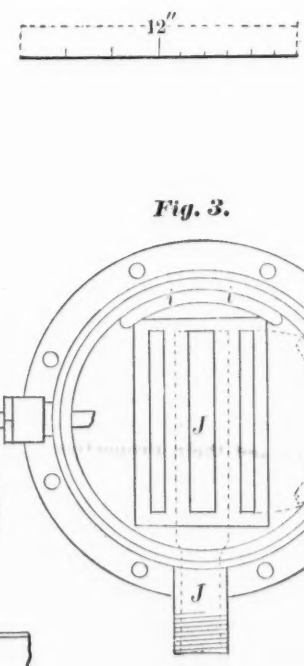


Fig. 3.



applied. The best arrangement of this system I have ever seen was upon a portable engine of about six horse power. Of course such an engine is not of suitable size to test the question properly. In this case the valves are placed upon the ends of the cylinder, the valve chests serving also as cylinder heads. The accompanying sketch will illustrate its principle as applied to this por-

table engine. I have, however, drawn it to a scale suitable for a 16″ piston, so that any party may test the question upon an ample scale. The sketch was made for a locomotive, each cylinder being cast with half of the saddle *A*, Fig. 1. This figure shows the end plan of the cylinder, the inflowing steam entering the valve chest (*B*, Fig. 2), through the passages *m*, and the exhaust passing out at the passages *n*. Fig. 3 represents the outer plan of valve chest, showing the disposition of the inlet ports in the upper half, and the exhaust ports in the lower half. The inlet valve, Fig. 6, works in the upper half. Fig. 4 shows the inner plan of the valve chest, the exhaust valve, Fig. 7, working in the lower portion, of course. The construction and operation are so clearly shown that only a brief explanation is needed. The two standards *F*, which carry the rockers *G*, are screwed to the cylinder, the rockers being united and worked by the rod *J*, this rod being connected to the eccentric by the rod *I*. The rockers *G*, are connected to the valve stems *E*, by the links *H*. The manner of attaching the valve stems to the valves is clearly shown in Figs. 5, 6 and 7. The inlet ports are just ¼″, and the exhaust ports just ½″, and the lap of the valves just ¼″. The maximum travel of the inlet valves is ½″, and that of the exhaust valves ¾″. The vibration of the rods *I* and *J* is 3″. Let the dimensions and explanation here given be strictly followed, and an excellent 16″ engine will be the result. Give the engine a single inlet and exhaust port at each end of the cylinder, instead of the many ports as here shown, and the travel of the inlet valves would need to be 1¼″, and that of the exhaust valves 2″, in order to secure the same area of port opening that the multiple system gives.

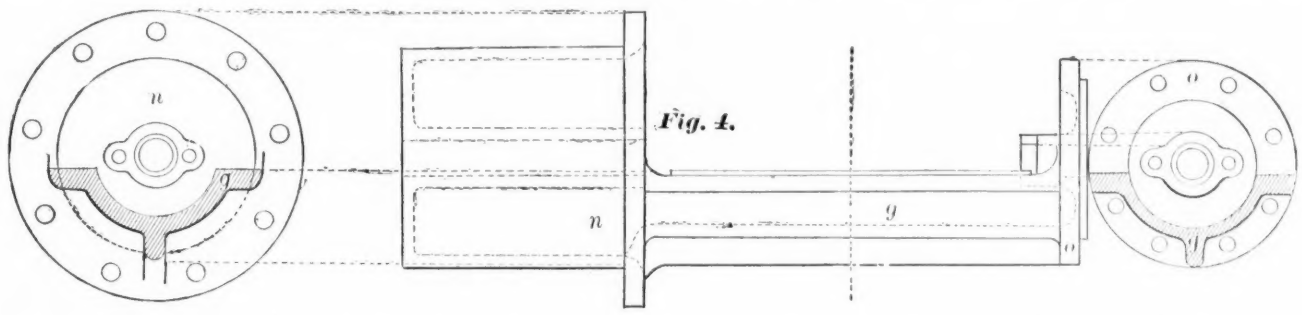


Fig. 4.

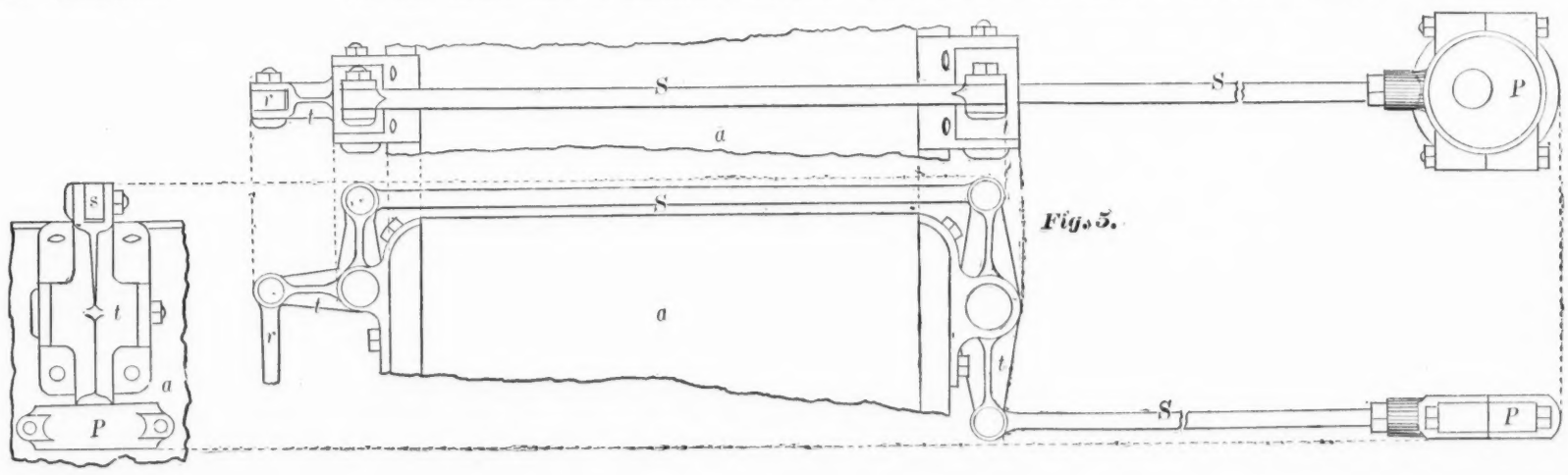


Fig. 5.

Practical Blacksmithing.—Selection of Materials and their Properties.

BY FREDERICK LEWIS.

It is proper that I should apologize to the readers of the AMERICAN MACHINIST for having neglected to continue my articles on blacksmithing, but the fact is that it has been difficult to find the time. I will endeavor to be more prompt in the future. Having described some of the most necessary tools for the use of blacksmiths it is proper now to turn our attention towards the selection of materials or stock.

The object of the writer in writing these articles is not to instruct the old and experienced workman, but to assist the apprentice and those who are learning with the expectation of advancing themselves in a more complete knowledge of their business.

It is unnecessary for me to go into the details as to how iron is manufactured for much has already been written upon the subject, but a few outlines may perhaps prove beneficial. I was much interested in the practical articles written upon the subject of "How Pig Iron is Made," by W. J. Williams, which appeared in the AMERICAN MACHINIST for March 27 and April 10, 1880, and I would respectfully refer the readers of my articles, to those referred to which describe the different processes through which iron ore has to pass before it is put into a shape known as pig iron.

It has been well said that "iron is one of the most useful substances known." This metal, when heated up nearly to a state of fusion, seems to be covered with a glaze or varnish, in which state it may be made to unite (by a succession of blows with a hammer) with another piece of the same kind of iron heated to the same temperature. Wrought iron may be heated, and, by means of the hammer, worked into almost every conceivable shape, yet it is very difficult to melt. Iron is commonly known under three heads, viz., cast iron, wrought iron and steel. Cast iron is produced by melting the ore in a blast furnace with coal or coke. Charcoal is used for making the finest and best quality of iron. More carbon is contained in cast iron than in steel, although the difference in the quality cannot be attributed to the presence of the carbon alone, as other impurities, such as flint, clay, silicates and earthy matters are also present. Cast iron may be hardened by heating to a higher heat than is necessary to heat steel, then plunged into cold water; but the hardness cannot be changed to any desired degree, as in drawing the temper of a piece of steel, neither can it be annealed by the same process as steel, but must be heated up to a white heat and kept at that temperature for a number of hours, then cooled gradually. It may properly be called an impure carbonized iron. Wrought iron is nothing more than cast iron with nearly all of the carbon and oxygen removed. It is represented by some as being a nearly pure decarbonized iron, and, as has been stated, is very difficult to melt, and when melted is of a spongy nature and difficult to manage. Wrought iron has for many years been used for different purposes in the arts and manufactures, and it is therefore necessary that a blacksmith should have the required knowledge to enable him to select a good quality.

A large majority of the accidents that happen, accompanied with loss of life and limb, may be traced directly to the use of poor and cheap material.

Among these accidents may be mentioned, boiler explosions, broken axles and shafting, broken rails, also different parts of engines and machinery, besides many of the prominent bridge disasters, among the most recent of which may be mentioned the *Tay bridge*. In this case it was proved that there were holes and imperfections in the castings and other parts of the bridge which were filled with cement or putty. These defects remained undiscovered until the fatal disaster which was attended with an enormous destruction of life and property.

Good iron is always the cheapest as there are no complaint after a piece of work is completed, and an individual or firm can build up an ever-increasing business reputation upon nothing, except good stock and materials.

I know that a blacksmith does not always have the power to select iron for himself, and the one who purchases for him knows only that in purchasing he has bought a lot of iron, respecting the quality of which he knows nothing. The man who works the iron is best qualified to select his material, as he knows the peculiarities of metal made by different manufacturers.

It is very difficult to determine the quality of iron from its appearance. Where a large quantity of iron is to be used, the best and cheapest way is to prepare a specimen and have it tested at some technical institution. This test will give the exact strains which the iron will stand up to, and including the breaking strain. Where small quantities of iron are to be used, a specimen may be tested in the following way: Take a suitable piece of a 1¼″ square bar, and, after heating it, punch a hole near the end, and another just back of it at right angles. Allow the iron to cool; then drive a drift into the hole nearest the end, then drive one into the other hole. This is a test of the tenacity of the iron. If there is much foreign matter contained in the metal, it will split at once, whereas good iron will stretch considerably before splitting.

To test the fiber of iron, take a flat or square bar and nick one side with a cold chisel, then place it through a hole in a swage block, or across the anvil, with the nicked side up. Give it a few blows with a sledge. If the iron is poor, it will break short, but if good, it may be doubled upon itself and hammered down upon the bar without breaking. In working, good iron, when cherry red, throws off a scale which strongly resembles in appearance that which falls from steel. A specimen of good iron, like the one referred to, may also be bent without nicking with a chisel, but will not show the fiber of the iron as readily.

There is a project to organize and build a 10,000 spindle cotton mill in Bath, Me.

Shop Notes.

A new compound pumping engine has just been completed by George H. Corliss at his works in Providence, R. I., calculated to pump 25,000,000 gallons in twenty-four hours. It has been set up at the works, and expert tests are being made to demonstrate its working capacity. The engine was designed for the sewage service of Boston.

The Pratt & Whitney Co., Hartford, Conn., have just shipped one of their upright drills and some cartridge case varnishing machines to Germany, a lot of screw plates and blacksmith's drilling machines to Brazil, and are about to ship some screw plates to Germany.

The Billings and Spencer Company, Hartford, Conn., are making on order 1,000 Billings' Pocket Wrenches a month for the manufacturers of the Columbia Bicycle.

The Hartford Machine Screw Company, have bought a lot adjoining their present works, 300 feet square, around a court, in which will be blacksmith shops. About 250 more hands will be employed.

Messrs. Hanna, Rhodes & Chapin have erected in Cleveland, Ohio, a manufactory of bolts and nuts. They will manufacture a full line of carriage, tire, spring, plow and agricultural bolts, also machine and cap screws, making a specialty of fine Philadelphia bolts. The works will be known as the Chapin Bolt and Nut Works.

The Powell Tool Company of Cleveland, Ohio, are building a 50-foot addition to their works, and will put in ten more forges.

The announcement is made that certain capitalists propose to establish a manufactory of fine cutlery at Oneida.

The Hudson River Tunnel between New York and Jersey City is to be over a mile in length. The tunnel is first lined with boiler iron and this is covered with brick work. The Erie City Iron Works of Erie, Pa., have taken the contract to supply all the iron work for the tunnel. The whole material to fill this immense contract is being furnished—both boiler iron and angle iron—by Carmichael & Emmens, 130 Cedar street, New York. They have already furnished some thousands of tons, and are shipping large quantities of iron from the different mills to carry forward engineering enterprise.

The new Mill of Miller & Young, Kansas City, Mo., is of brick, three stories, basement and attic, and is 45x50 feet, with an engine room 25x45 feet, all roofed with iron. The engine is the Buckeye automatic, 15x28, with two steel boilers, 125 horse-power.

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NEW YORK, JUNE 26, 1880.

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Disposing of Poor Machinery.

At this time, the semi-annual "taking stock" is about to begin in many machinery establishments. That the schedules of stock on hand will show much smaller totals than for any one of a number of years previous, is a fact over which it is proper to express the most positive congratulations. It is, just now, not an uncommon thing to find a machinery manufacturer so crowded with orders as to be unable to fill all those offering. Such a booming condition of business is not likely to last many months, but, at all events, it augurs well for the volume of trade in the future. But the stock-taking ought to show something more than the amount of machinery and tools made up for sale. It should give a correct enumeration of the machines, tools, and appliances used in the conduct of the business, together with a fair valuation upon them all. Unless this is carefully attended to, the general result is likely to be deceptive. There are many machinery establishments that make no sort of estimates for the depreciation in value of their working tools, but count upon obtaining the same duty from the whole plant, year after year, without cost for repairs or renewals. It is, therefore, not surprising that they often fall very short of reaching satisfactory business results. Where no allowance has been made for cost of improving the plant, or for keeping it up to the proper standard, very little is likely to be expended in that direction, beyond the most pressing demands. As a consequence, the appurtenances are likely to deteriorate, rendering it impossible to do work as promptly, cheaply, and thoroughly as other shops provided with improved outfits. With good machinery and appliances, the deterioration goes on slowly, but the very best machinery will wear out in time, and that possessing the greatest improvements may become too obsolete to be used to advantage, long before it wears out. It is folly to ignore these facts. Chordal, in his letter this week, very pithily and sensibly advises machine men to patronize the junk shop more than they are in the habit of doing, not as buyers, but as sellers of junk material. It may look extravagant to a business man, who is not a mechanic, to see strong and but little worn steam engines and machines taken out, sold to the junk dealer, and new machinery bought to replace them; but unless a shop manager has the stamina to discard inferior machines, though in good condition, and put superior machines in their places, he will be surpassed by his more enterprising rivals. It is mistaken economy to fritter away labor and time with inefficient tools rather than buy new ones.

There is a large class of machine men who are content to follow in the wake of others. They are drawn along by the power developed by their energetic contemporaries. This class of men is too large to be crowded out by any improvements that may be made. They obtain patronage from those as far behind the march of progress as themselves, and who never catch up. They patronize the junk shop, not as sellers, but as buyers. It is useless to try to sell the best machinery to these men. They watch the junk shop advertisements, in the daily papers, of "A lot of second-hand machinery cheap for cash," buy the most antiquated and labor-consuming machines, and chuckle over the good bargains they make.

We heartily second Chordal's advice to progessive machinery men to patronize the junk shop by disposing of inferior and disordered machinery and tools. They need not be sold so very low, for the junk men can obtain good prices for them by offering "great bargains" to a certain class of buyers. It frequently happens that an obsolete and wasteful second-hand machine is sold for more than the price of a new and improved machine. Some buyers don't think of looking for new machinery. They prefer to get everything second hand at "a bargain." The junk shop proprietors find a profitable business in providing these bargains, and many enterprising shop owners would do well to furnish them material to do so.

Shop Mistakes.

We have noticed from time to time in visiting different shops a peculiar indifference on the part of some of the workmen, in regard to the manner in which they commence a piece of work. Suppose we ask one of these men a few questions, as, What is this piece of work for? "Well, I forget, and I do not believe the foreman told me what it was for," may be the answer. What are to be the sizes of those parts? "I think they are to be so and so (naming certain sizes), but am not positive," is the reply. After asking some further questions we find that the man knows little, if anything, about the piece of work he is doing, and we think it very strange that such a state of things should exist. But thinking that we may have been deceived, we pass on a little further and observe another man examining a piece of work and measuring the same. After scratching his head for some time he starts in search of the foreman for further instructions. When that individual is found he proceeds at once to the bench to examine the piece of work. His examination proves satfactory, and further instructions are given. By making a few inquiries of the workman referred to, we find that, although a good mechanic, he knows very little concerning the piece of work in progress. Being mystified still further we interview the foreman, and proceeding cautiously, we ask him the question: How is it that these workmen under your charge appear to know so little about their work? and receive the following answer, "Oh, they know too much already. If I were to tell them too much they would be as wise as I am, and very likely would make an effort to get my position. I do not believe in telling workman all I know."

By making further inquiries we find that the workmen under his charge are given pieces of work and instructed step by step until the job was finished. The workman is not allowed to think for himself, but the foreman furnishes the brains and does the thinking for the whole shop. Why? Simply because the foreman is afraid that he would instruct his men to the extent that some one might try to get his position.

A shop under the management of such a foreman is the worst place in the world to leave an apprentice to learn a trade, for just as soon as his ambition begins to show itself, in offering his ideas about certain pieces of work, the selfish foreman will put a damper on his progress by telling him that "the boys now-a-days know entirely too much." It requires a boy with an excellent spirit to bear such replies, and this, above everything else, will make an ambitious boy homesick, and awaken a desire in him to quit the shop and business forever.

We hope that this shoe will not fit any of the readers of THE AMERICAN MACHINIST, for the class of men referred to are not given much to reading, or any other mental exercise which will benefit the community at large.

We will endeavor to show some of the evils attending such methods of handling men. Let a workman who has become accustomed to work in the shop referred to, leave it and get employment in a shop where the workmen are controlled by a foreman who not only allows them to think for themselves, but will give out a piece of work with explicit directions, after which he will require the workman to explain the same, or read a drawing of the work required in order to see that nothing has been misunderstood. The foreman then leaves the workman to devise the proper course to pursue in accomplishing his task, thus making him responsible for his work, and necessarily to feel an interest which he would not otherwise experience.

We are acquainted with an instance where a workman was told to drill and tap a large number of holes to fit a certain size bolt. Instead of getting the proper tap and measuring it to find the size of the drill, he asked a fellow workman what size it should be; having misunderstood the directions given and made a large number of the holes too large, so that to get a full thread in the holes they had to be tapped larger, requiring larger bolts than those ordered.

We might enumerate plenty of cases where workmen have thoughtlessly made mistakes, such as grinding a drill left handed, and prying the tail end of a lathe around in trying to make it turn tapering. These things look very ridiculous to an outsider, yet such mistakes have been made by men who were much amused when speaking of them afterwards.

The proper remedy for these evils is to require workmen, after receiving the proper instructions, to think and act for themselves. Employers and foremen should try to encourage thoughtfulness on the part of those at work under their charge, and thus draw out many ideas which would not otherwise be developed. Through this process we have known valuable inventions to be made, by means of which not only the employers, foreman and inventor (considering him to be a poor man like most inventors), received the benefit, but also the workmen in the shop, for extra work would be required in manufacturing the patented articles.

We wish to call the attention of anonymous correspondents to the fact that their communications, although in many cases well prepared, are worth only half a cent a pound for waste paper. Unless these are very voluminous it does not pay the office boy to collect them from the waste paper baskets and sell them. Correspondents who sign their names to anything sent to this office may be assured that due attention will be given to what they have to say. We receive a great many questions to be answered in our department of "Questions and Answers" signed by nothing but initial letters. While we never publish full names in this location we will positively give no attention to any question that is not accompanied by the writer's name and address.

International Exhibition Mistakes.

The managers of the World's Fair of 1883 to be held in this city, will do well to avoid a serious mistake committed by the commission in charge of the Centennial Exhibition at Philadelphia. The showing of steam engines in operation *doing work* is, or should be, one of the most interesting and instructive features of universal exhibitions. Engine builders appreciate this fact and have always been ready to furnish power, more than required, to drive the mechanism shown in motion. But at the Centennial the furnishing of the entire power for Machinery Hall was assigned to a single engine-builder, and though much credit is due to him for the efficient manner in which this trust was discharged, it was a plan never before nor since attempted at an International Exhibibition, and one that caused the most widespread dissatisfaction. There were eight main lines of shafting at Philadelphia, which might properly have been driven by eight different manufactures of engines, and presenting the comparative merits of them all. Instead of such an arrangement, however, power was communicated from one large engine by means of a complex (but finely executed) system of gears, such as it would be almost impossible to find in regular use by any manufacturing establishment in this country. Foreign engineers were greatly surprised to see a complete gearing system displayed at this great representative exhibition of American industrial progress, especially as it had for years been the pride of our mechanical engineers that we had cast off the European system of transmitting power by gears, and adopted belting in its stead as a simpler and better plan. At the last Paris Exposition, from a dozen to twenty different horizontal engines furnished power to main shafts. At the Vienna Exposition, the American section alone had four engines doing work. We contend that it is unjust and impolitic to delegate the supplying of power for any International Exhibition to a single concern. It is not difficult to obtain engines of sufficient power to run each a separate line of shafting. The specifications should call for

engines of not less than a given power, and they should be accepted up to any capacity the builders desire, if space can be set apart for the erection of the largest.

The Centennial engine had a capacity of 1400 H.P., but at no time during the exhibition did the power required of it exceed 400 to 600 H.P. Where several large engines are used, should one get disabled its line of shafting could at once be connected with another (for which pulleys in line should be provided), and no interruption caused to the machinery requiring power.

Agricultural machinery should be run by agricultural engines, and not by a horizontal engine as built for manufacturing purposes, as was done at the Centennial. Visitors should be permitted to see mechanical exhibits as nearly as possible under the same conditions presented in actual use.

The incorporators of the World's Fair of 1883 are men eminent for public spirit and ability, and we hope to see errors such as here mentioned avoided.

LITERARY NOTES.

THE CARPENTER AND JOINER MODERNIZED. Third edition, revised and corrected, containing new matter of interest to the carpenter, stair-builder, carriage builder, cabinet-maker, joiner and mason, also explaining the utility of the slide-rule. Illustrated with numerous engravings. By ROBERT RIDDELL, teacher of the artisan class in the Central High School of Philadelphia, and author of other practical books. Quarto oblong. Price $7.50. Published by Claxton, Remsen & Haffelfinger, Philadelphia, Pa.

The former editions of this work contained models in card-board which were backed with linen so as to make them durable. These models, in addition to increasing the expense of the book, made it more heavy and cumbersome. In the present edition these models have been left out, and plain concise illustrations put in their place, at the same time giving explicit directions how to make the models in card-board referred to, thus making the book much more attractive, and just as valuable in this respect.

Experience has taught that the plan of having the student or apprentice make the models is altogether the most desirable, as he then gets a better idea of the figure to be represented and at the same time learns to model in card-board, which is of great advantage to the artisan, new and advanced ideas have been introduced bringing the reader up to the present and most approved practice in carpentry. The problems in geometry are of the plainest practical character, and are adapted to being worked out by the use of the slide-rule, that valuable instrument which has been so little studied by artisans heretofore, but which is invaluable to them in their business. Many of the designs illustrated are new and on the whole we consider the book well adapted to the class of artisans for whom it is intended and will doubtless be perused by them with pleasure and profit.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) H. W. S., Bordentown, N.J., writes: The following is a subject of controversy. A party contemplates building a tug-boat 65 feet long, to draw 6 feet of water, and to use a wheel 6 feet in diameter. The arguments are in relation to the size of the engine, as to which would be the best, viz., a 16″×16″, a 16″×20″, or a 16″×22″. A man arguing in reference to the 16″×22″ says that it would take less coal, water, oil, attention, and no larger boiler to run a 16″×22″ than it would take for the 16″×16″. In addition, he claims he would have more power and require no more money in first or last cost. Another man claims that a 16″×20″ engine will save more coal and develop more power than a 16″×16″ engine, though not so much as the 16″×22″ engine, while yet another man claims that a 16″×16″ engine will require less boiler, coal, water, oil and attention than the 16″×20″ engine while performing the same work, allowing the pistons in both to have an equal velocity. Here is a marked difference of opinion. I hope that you will give your views as to which is the most economical, as there seems to be much confusion among tug-boat men and builders in regard to stroke of piston. *A.*—A 16″×22″ engine will unquestionably require less steam than a 16″×16″ engine to develop the same power, allowing the pistons to travel at the same velocity in both. The reason for this is that the former engine has the advantages of the extra expansion, and while the piston travels with the same velocity, the crank will not make as many revolutions per minute as the latter. If you will figure the horse power of the 16″×16″, also the 16″×22″, using the same piston speed, you will find all the evidence required to prove that the latter engine will develop more power, making less revolutions than the former; consequently it will require less steam, boiler, oil and attention. The advantages of a not excessively long stroke have been proved in practice repeatedly, both in marine and stationary engines.

(2) H. H., Baraboo, Wis., asks: 1. Can an electric motor applicable to road wagons be obtained? If so, where? *A.*—We know of none that can be regarded as a success as yet. 2. How can I get information concerning electric motors? *A.*—By writing to the different manufacturers. One of the most simple electric motors is probably made by Thos. A. Edison, Menlo Park, N.J. Any dynamo-machine is capable of being reversed and used as a motor, which may be done by running a current of electricity to it through the same wire which gives out the current when the machine is driven by power.

(3) F. S., New York City, writes: I desire to make a spring of a flat piece of steel 1″ wide by ⅛″ thick. What is the best way to temper said steel so as to get a tough and durable spring? I find there is very little known in the trade about spring tempering, and would like to be informed. *A.*—You neglected to give the length of spring, whether of a uniform thickness, or tapered at one or both ends; also the kind of steel used, as much depends upon the quality. It is difficult to make a good spring out of poor steel. Good steel is always the cheapest. We have found satisfactory results in tempering springs by heating them in a "muffle," or where a "muffle" cannot be procured a charcoal fire will do. When hot enough the springs are to be immersed in oil, after which they were carefully blazed off. Where great toughness is required, the blazing off may be performed twice or three times, as it does not (if carefully done) injure the spring, as many suppose. The above directions will give satisfaction every time with good steel, but the results will differ very much with inferior grades of steel.

(4) H. J., Newark, N. J., asks: Which is the best way to clean brass that has formerly been polished—as the jacket on a cylinder, or dome? *A.*—Take some finely powdered sal-ammoniac, and moisten with water; or roche alum one part, water sixteen parts; mix thoroughly. The article to be cleaned must be warmed, then rubbed with either of the above mixtures and polished with fine, dry tripoli. This process will produce a very fine polish.

Business Specials.

40 cts. a line for each insertion under this head.

The new Pulsometer Steam Pump is more economical than any other. "We have had in constant operation for two years one of your new Pulsometers. During this time it has elevated to the top of our five story building all the water that we have used in our laundry. The entire expense for repairs upon it has not exceeded THREE DOLLARS. We consider it the most economical and best steam pump in the market."—Thos. J. Pell, Sup't Empire Steam Laundry, 75 & 77 King Street, N. Y. Office of New Pulsometer, 40 John Street, N. Y.

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See Christiana Machine Co.'s adver., next number.

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A new automatic valve gear for steam engines complete. Address, Ed. F. Williams, P. O. Box 148, Leadville, Colorado.

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W. Barnet Le Van, Mechanical and Consulting Engineer, 3607 Baring Street, Philadelphia, Pa.

Rare opportunity to purchase a complete set of the "Encyclopædia Britannica," 8th edition. Twenty-three books, bound in cloth, at $55. Address, J. F., care American Machinist, 96 Fulton Street, N. Y.

John Douglass, common and fine patterns made to order, also car wheels, working models, and experimental machinery. Shop at Washburn, Hunts and Co. Wheel Foundry, cor. Warren and Bay Sts., Jersey City, N. J.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

Second-hand 80 H. P. Tubular Boiler for sale cheap; also one large Blower. David W. Pond, Worcester, Mass.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

MANUFACTURES.

Wm. Wright, Newburgh, N. Y., has lately taken out a patent for a new engine valve, and has built some engines after the new pattern. They can be run safely at the highest speed, and present some especially valuable features. Among the engines he is now building are one of 400 H.P. for the Gautier Steel Co., Johnstown, Pa.; one of 350 H.P. for Wheeler, Madden & Clemson's Saw Works, Middletown, N. Y.; one of 150 H.P. for the Rice Planter's Manufacturing Co., Savannah, Ga.; one of 400 H.P. for the Western File Co., Beaver Falls, Pa.; one of 175 H.P. for Broadhead & Sons, Johnstown, N. Y.; one of 150 H.P. for Pinneo & Daniels, Dayton, O.; one of 175 H.P. for E. A. Galindo's Ornamental Moulding Mill, Harlem, N. Y. City; one of 50 H.P. for the Devoe Manufacturing Co., New York; one of 50 H.P. for Vosburgh & Co., Brooklyn, N. Y. (new style); one for the Dolphin Mills of 400 H.P. (compound); one of 150 H.P., for J. H. Hollenbeck, printer, N.Y. city; one of 400 H.P. (compound) for Dalton Mills, Paterson, N.J; one of 150 H.P. for a cotton mill at Charlotte, N.C., and one of 300 H.P. for a hosiery mill in New Brunswick, N. J. He has just completed one of 150 H.P. for Barney & Smith's Car Works, Dayton, O.; one of 175 H.P. for Mead & Nixon, of the same place; one of 300 H.P. for St. Paul Warehouse Co., St. Paul, Minn., and one of the new style for Sterling Iron & Railway Co., for their mines. He has lately taken an order to build a four-million gallon pumping engine for Yonkers, N.Y. The last named city has had one of his pumping engines in use for four years, during which time it has given the highest regular duty on record.

The Whitin Machine Works, Whitinsville, Mass., employ 768 hands. On a recent pay-day they received $22,000.

The Northampton Emery wheel Co., has bought a large grindstone quarry in Illinois.

The Hopedale Machine Co., and the Hopedale Furnace Co., of Milford, Mass., have consolidated. An addition, 40×66 feet, has been put on their machine shop, and the foundry has also been enlarged.

The Furst & Bradley Manufacturing Co., of Chicago, have just moved into their new foundry. It is four stories high, and covers an area of 100×151 feet. The works of the company cover some ten acres.

The Union Rolling Mills of Chicago are progressing rapidly with the work on their new blast furnaces, the foundations for which are now completed, and the brick work well under way. It is expected that both furnaces will be in operation by October 1st.

The I. P. Morris Co. have contracted to supply the Belmont Water Works, at Fairmount Park, Philadelphia, with Strong's Patent Feed Water Heater and Filter, for their steam boilers.

F. Winston, Merrell & Co., is a new firm which is to establish works in Chicago for the manufacture of railway frogs. The location of the new works is on the north branch of the Chicago river, near the rolling mills, and will have a capacity of turning out 60 frogs a day.

J. H. Chadwick & Co., of Fort Hill Square, Boston, are burning screenings for fuel, using the Jarvis furnace.

The building and plant formerly used by the Chicago Steel Casting Co., is now styled the Jefferson Foundry.

Small, Gould & Co., paper manufacturers of Baldwinsville, N.Y., have reset two tubular boilers with the Jarvis setting.

Mr. Ambrose Webster, Manager of the American Watch Tool Co., Watham, Mass., writes us as follows: John Adt's letter of May 18th, in which he alludes to a metric wire gauge, leads me to give a few facts on the subject. When I adopted the metric system of measurement for the American Watch Co., of Waltham, a metric wire gauge became a very useful tool. The American Watch Tool Co. use that system, and make wire gauges for their own use and supply them to their customers, many of whom have followed my advice and adopted that system, notably, J. Rotherham & Sons, England; the Waterbury Watch Co., E. N. Welch Clock Co., etc., etc. I am pleased to have the indorsement of your valued correspondent, Chordal, as well as that of Mr. Adt.

The Hot Air Boot Tree Manufacturing Company has been organized in Boston. Capital $500,000.

Kendall & Roberts, of Cambridgeport, Mass., have shipped a new steel boiler to R. S. Frost & Co., Hillsborough Bridge, N.H., which will be set with the Jarvis setting.

The Gold Medal Sewing Machine Works at Orange, Mass., have increased the number of their hands to 475, 375 of them being added to the machine shops and 100 to the foundry.

The Cape Ann Forge Works, Gloucester, Mass., have made alterations to enable them to do all kinds of heavy forgings and railroad work, in addition to their anchor manufacturing business. They are now at work on heavy shafting for the Holyoke Machine Company. They have all the work they can handle and are running full time, with a large force of workmen.

D. M. Dillon, Fitchburg, Mass., is making for Crocker, Burbank & Co., about fifty tons of tanks and soda-ash reclaimers, to be set with the Jarvis setting.

The machine shop at Beaver Falls, Pa., for the manufacture of machinery for Emerson, Smith & Co.'s file works will soon be in running order.

The Schuylkill Iron Company have purchased a lot, 650x200 feet, on the Schuylkill at Norristown, on which they are to erect a blast furnace to use the Lowe process.

Hartford, Conn., is to have a new pin manufactory, P. Jewell & Sons being prime movers in the enterprise.

The Gardner machine gun, made by the Pratt & Whitney Co. of Hartford, is attracting the attention of the United States Government, and recently some very interesting trials of the gun have been made by the Government officials.

The Holyoke (Mass.) Water Power Company are to put up three buildings to be used for manufacturing purposes.

The Fishing Creek Manufacturing Company has been organized at Rock Hill, Mo., with a capital of $50,600.

The E. Horton & Son Co., Windsor Locks, Conn., are improving their machinery and patterns. They propose to make all the parts of their chucks interchangeable. They have also put in some automatic machinery to better accomplish better work. A new combination chuck, which possesses great advantages, will soon be placed upon the market by this company. Among their recent orders is a large one from Germany. Their shops are running 13 hours a day, and, being pressed with orders, they are about to enlarge.

The Roy Stone Hydraulic Mining and Dredging Company have just shipped ten thousand dollars worth of machinery to Oroville, Cal., where they are beginning operations. Mr. Samuel S. Webber, well known to the readers of the AMERICAN MACHINIST, has accepted the position of Chief Engineer to the company, expecting to return, however, in the fall to attend the November meeting of the American Society of Mechanical Engineers. In the company's mining outfit are included a No. 7 and a No. 10, M. T. Davidson steam pump, made especially for heavy pressures.

Machinists' and Engineers' Supplies.

NEW YORK, June 10, 1880.

The supply market continues dull for the season, and there is very little change either for better or worse.

In certain branches of manufacturing there is some activity in preparing price lists and catalogues for the fall trade.

As stated last week, the effect of the meeting of the Brass and Copper Manufacturers was to reduce the price of manufactured copper three cents per pound, as shown by the following list of net prices, which took effect June 4, 1880:

SHEATHING, BRAZIERS' COPPER, BOLTS, ETC.

	per lb.
Braziers' copper, ordinary sizes, 16 oz. per square foot and over	28c
Braziers' copper, ordinary sizes, under 16 oz. and over 12 oz. per square foot	30c
Braziers' copper, 10 and 12 oz. per square foot	32c
Braziers' copper, lighter than 10 oz. per square foot	34c
Circles, less than 84 inches in diameter	31c
Circles, 84 inches diameter and over	34c
Segment and irregular pattern sheets	31c
Locomotive fire box sheets	28c
Sheathing copper, over 12 oz. per square foot	26c
Bolt copper	28c

No copper is sheathing except 14x48 inches, and not to exceed 34 ounces to the square foot.

TINNING.

Sheets 14x48", 6c. per sheet; all other sheets, 2½c. per square foot. For tinning both sides, double the above amount.

There will also be a reduction of 2c. per pound in the list prices of roll and sheet brass from list No. 21.

Wm. Cooke, 6 Courtland Street, New York, has taken the sole agency for this city and vicinity for Watson's portable forges and blowers.

Iron Review.

NEW YORK, June 10, 1880.

The Pig Iron market continues in a demoralized state; the sales of American iron are small and prices low. There is more foreign iron being sold now than for a short time past. Prices for pig are quoted this week at $23 to $24 for No. 1; $22 to $23 for No. 2; and $21 to $22 for forge. Old rails $24 to $25. Wrought iron scrap at $22 to $23. Bar iron remains unchanged.

Pierson & Co., 24 Broadway, N. Y., under date of June 10, 1880, quote nominal prices out of store as follows:

Iron Rails, $50 to $57, according to weight; Fish Plates, 2¾c. per lb.; Railway Spikes, 3¼c.; Bolts and Nuts, 3¾c.; Common Bar Iron, nominal, 2 7-10c., basis from store; Refined do. 3c., basis; Ulster, 3 6-10c. basis; Machinery Steel, 6½c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 6¾c.; Sheet Iron, 4c., basis; Angle Iron, 3 6-10c.; Tee Iron, 4¼c.; Band Iron, 3½c.; Hoop Iron, 3 7-10c., and up according to size; Horse Shoe Iron, 3½c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies as follows:

Flange, 4¾c.; C. H. No. 1 Shell, 3½c.; Tank, 2¾c.; C. No. 1, 3¼c.; Boiler Tubes, 50% discount from list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of June 10th, 1880:

No material change in Metal Market since our last report. London quotes Pig Tin £70 and Singapore $22¼; Spot Market, Banca Tin, scarce, 20½c.; Malacca and Straits 15¾ to 16c; Australian and English Refined 15¼ to 15⅝c.; Billiton 15½c.; Lamb and Flag16½c.; Pig Lead 5c.; Antimony 19c. for Cookson; 17½c. for Hallett; Spelter, dull.; 5½c. for Domestic; 6c. for Silesian; Ingot Copper 18½c. and upward; Nickel $1.25; No. 1 Solder 10c.; "half-and-half" 11½c.

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Wanted—Ten first-class moulders. Address Holyoke Machine Co., Holyoke, Mass.

Wanted.—Twenty to thirty good machinists. Address, Pratt & Whitney Co., Hartford, Conn.

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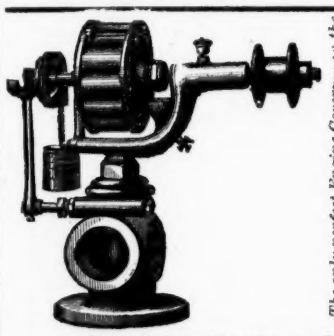

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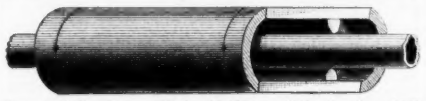

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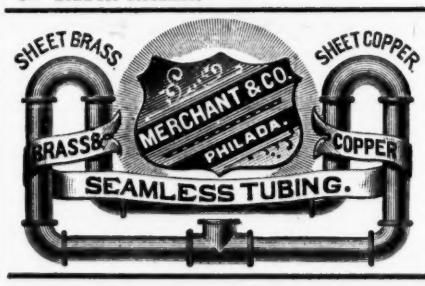

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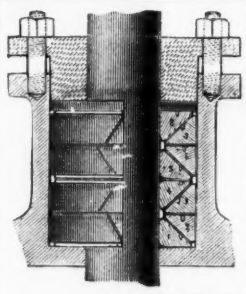

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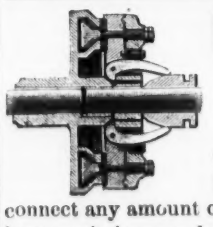
JAMES D. FOOT, Whitinsville, Mass., Oct. 31st, 1878.

Dear Sir:—For the past two years we have been using special Files made by KEARNEY & FOOT in place of Stubs, and are well satisfied with them. We consider them nearly or quite equal to Stubs' Files, and shall continue to use them so long as the present standard is maintained.

Yours truly, G. E. TAFT, Sup't.

We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.

Respectfully, KEARNEY & FOOT.



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We manufacture the "Giant Friction Clutch Pulley," known as the "Captain." Is the **Best in the World** for connecting the gearing of callender rolls, hoisting coal, logs or freight. Our Clutch can connect any amount of power, at any speed, without slacking the motive power in the least, and gives no shock, is easy to ship and unship, in *fact*, this is the only Clutch that can do heavy work satisfactorily. D. FRISBIE & CO., New Haven, Conn.

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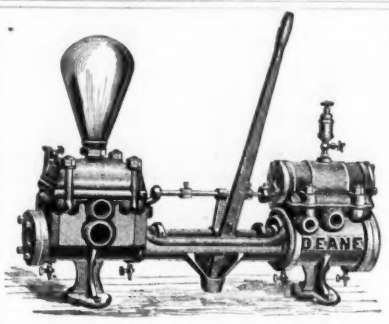

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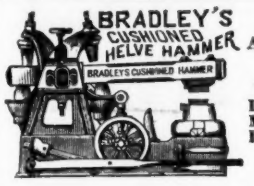

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Being the highest award given any goods of their class in America or Europe.

IT HAS MORE GOOD POINTS, LESS COMPLICATION,
MORE ADAPTABILITY, LARGER CAPACITY,
DOES MORE AND BETTER WORK, TAKES LESS POWER,
COSTS LESS FOR REPAIRS
THAN ANY HAMMER IN THE WORLD.

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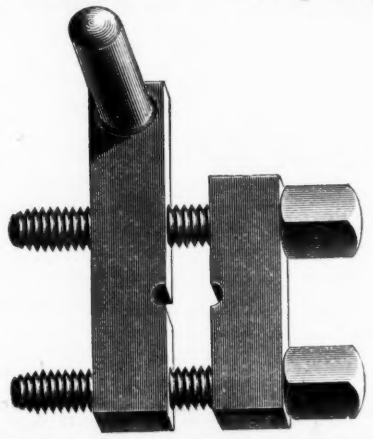

These are made from the Steel Bar and hardened all over, as well as the Screws. They will carry all that can be put on them. The tail is Steel, turned and driven into a taper hole. The Screw Head is a ball, and will accommodate itself to a straight or taper piece.

PRICES.

No. 1 opens	1	inch,	- - -	$1.25
" 2 "	1¼	"	- - -	1.50
" 3 "	2	"	- - -	1.75
" 4 "	3	"	- - -	2.00

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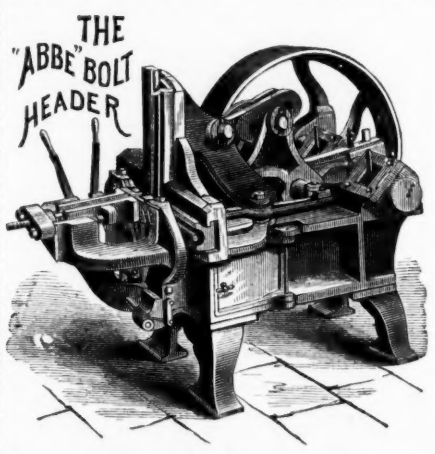

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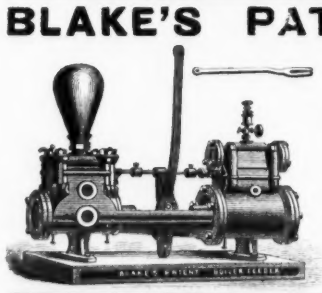

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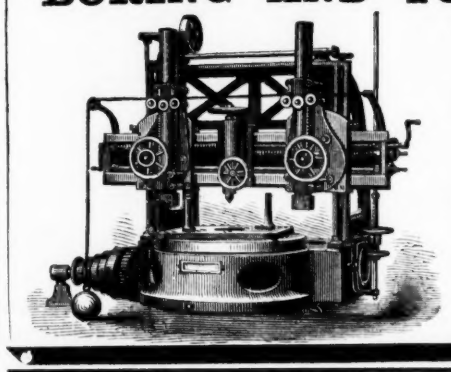

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IMPROVED MILD-CENTRED CAST STEEL

For Taps, Reamers, Milling Tools, &c.

Warranted not to crack in hardening Tools of any Size.

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Steam Engines.

Capacity to bore Cylinders 110 Inches Diameter, and turn Fly Wheels of 24 feet.

THE NORWALK IRON WORKS CO.

South Norwalk, Conn.

The Roy Stone Hydraulic Mining and Dredging Company have just shipped ten thousand dollars worth of machinery to Oroville, Cal., where they are beginning operations. Mr. Samuel S. Webber, well known to the readers of the AMERICAN MACHINIST, has accepted the position of Chief Engineer to the company, expecting to return, however, in the fall to attend the November meeting of the American Society of Mechanical Engineers. In the company's mining outfit are included a No. 7 and a No. 10, M. T. Davidson steam pump, made especially for heavy pressures.

Machinists' and Engineers' Supplies.

NEW YORK, June 10, 1880.

The supply market continues dull for the season, and there is very little change either for better or worse.

In certain branches of manufacturing there is some activity in preparing price lists and catalogues for the fall trade.

As stated last week, the effect of the meeting of the Brass and Copper Manufacturers was to reduce the price of manufactured copper three cents per pound, as shown by the following list of net prices, which took effect June 4, 1880:

SHEATHING, BRAZIERS' COPPER, BOLTS, ETC.

	per lb.
Braziers' copper, ordinary sizes, 16 oz. per square foot and over	28c
Braziers' copper, ordinary sizes, under 16 oz. and over 12 oz. per square foot	30c
Braziers' copper, 10 and 12 oz. per square foot	32c
Braziers' copper, lighter than 10 oz. per square foot	34c
Circles, less than 84 inches in diameter	31c
Circles, 84 inches diameter and over	34c
Segment and irregular pattern sheets	31c
Locomotive fire box sheets	28c
Sheathing copper, over 12 oz. per square foot	26c
Bolt copper	28c

No copper is sheathing except 14x48 inches, and not to exceed 34 ounces to the square foot.

TINNING.

Sheets 14x48", 6c. per sheet; all other sheets, 2½c. per square foot. For tinning both sides, double the above amount.

There will also be a reduction of 2c. per pound in the list prices of roll and sheet brass from list No. 21.

Wm. Cooke, 6 Courtland Street, New York, has taken the sole agency for this city and vicinity for Watson's portable forges and blowers.

Iron Review.

NEW YORK, June 10, 1880.

The Pig Iron market continues in a demoralized state; the sales of American iron are small and prices low. There is more foreign iron being sold now than for a short time past. Prices for pig are quoted this week at $23 to $24 for No. 1; $22 to $23 for No. 2; and $21 to $22 for forge. Old rails $24 to $25. Wrought iron scrap at $22 to $23. Bar iron remains unchanged.

Pierson & Co., 24 Broadway, N. Y., under date of June 10, 1880, quote nominal prices out of store as follows:

Iron Rails, $50 to $57, according to weight; Fish Plates, 2¾c. per lb.; Railway Spikes, 3¼c.; Bolts and Nuts, 3¾c.; Common Bar Iron, nominal, 2 7-10c., basis from store; Refined do. 3c., basis; Ulster, 3 6-10c. basis; Machinery Steel, 6½c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c; Nail Rods, 6¼c.; Sheet Iron, 4c., basis; Angle Iron, 3 6-10c.; Tee Iron, 4¼c.; Band Iron, 3½c.; Hoop Iron, 3 7-10c., and up according to size; Horse Shoe Iron, 3½c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies as follows:

Flange, 4¾c.; C. H. No. 1 Shell, 3½c.; Tank, 2¾c.; C. No. 1, 3½c.; Boiler Tubes, 50% discount from list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of June 10th, 1880:

No material change in Metal Market since our last report. London quotes Pig Tin £70 and Singapore $22¼; Spot Market, Banca Tin, scarce, 20½c.; Malacca and Straits 15¾ to 16c; Australian and English Refined 15⅞ to 15¾c.; Billiton 15½c.; Lamb and Flag16½c.; Pig Lead 5c.; Antimony 19c. for Cookson; 17½c. for Hallett; Spelter, dull.; 5½c. for Domestic; 6c. for Silesian; Ingot Copper 18½c. and upward; Nickel $1.25; No. 1 Solder 10c.; "half-and-half" 11½c.

WANTED.

Wanted—Ten first-class moulders. Address Holyoke Machine Co., Holyoke, Mass.

Wanted.—Twenty to thirty good machinists. Address, Pratt & Whitney Co., Hartford, Conn.

Wanted, experienced machinists—steady work—good pay. David W. Pond, Worcester, Mass.

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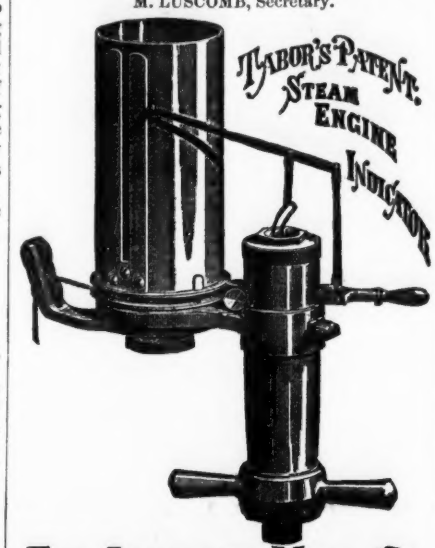

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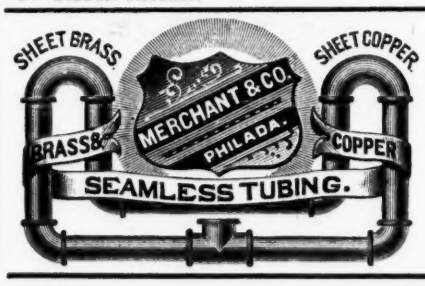

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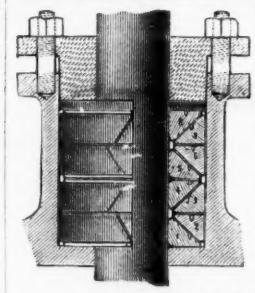

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Full Weight Hand-Cut Files.

The best and cheapest in the end. Send for quotations. The files speak for themselves in the following testimonial. Read it.

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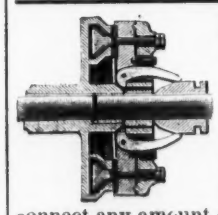

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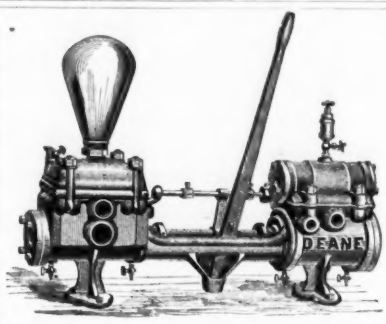

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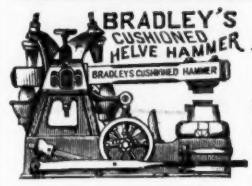

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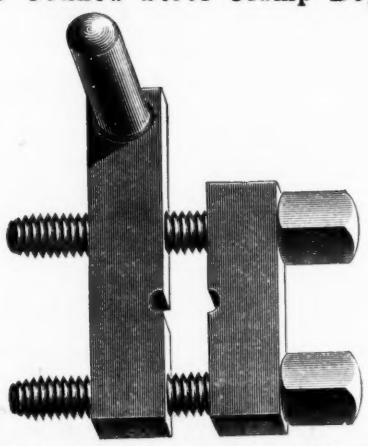

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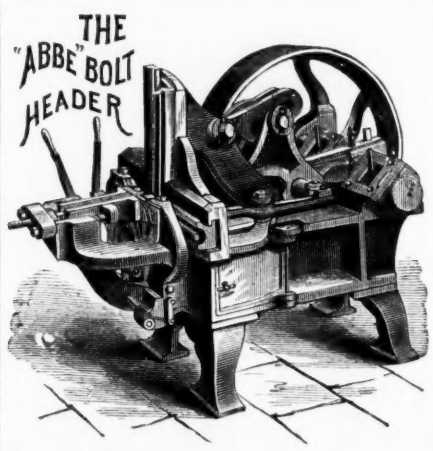

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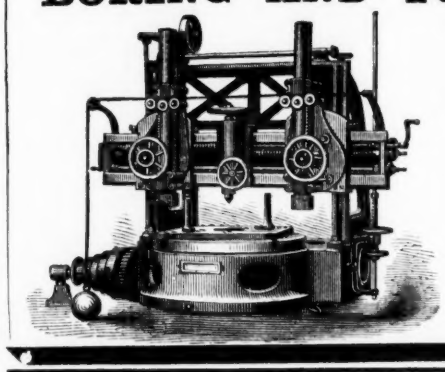

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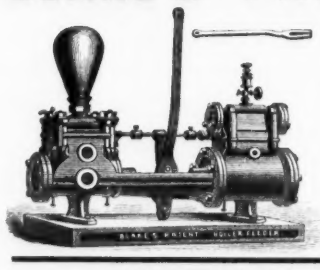

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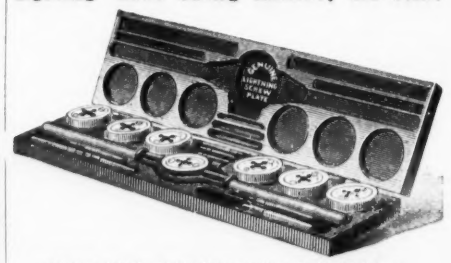

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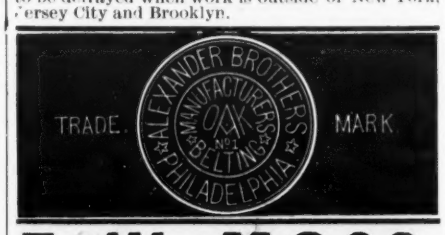

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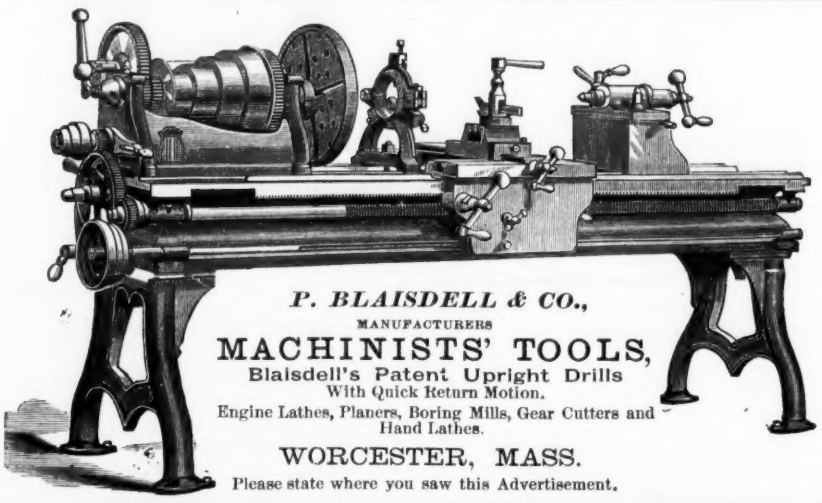

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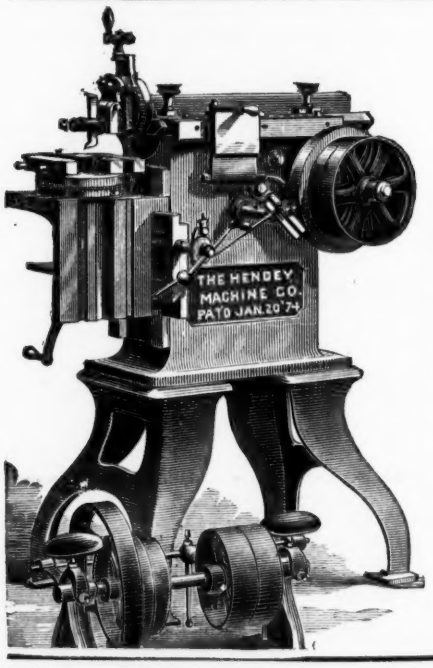

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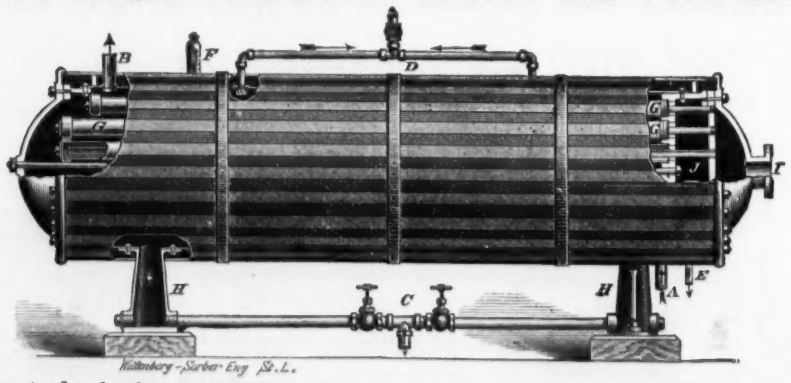

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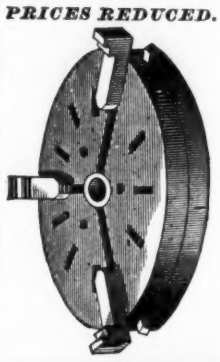

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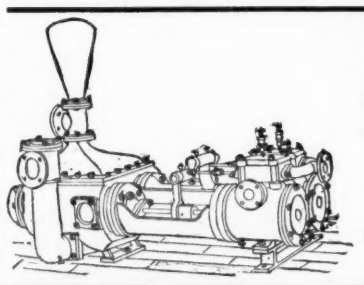

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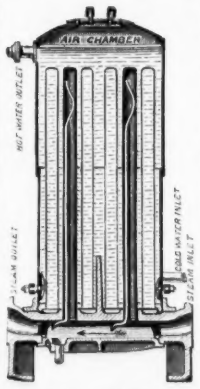

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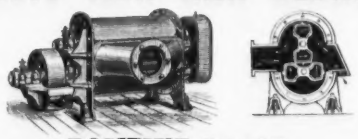

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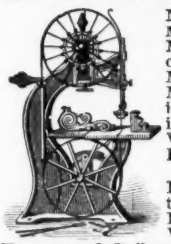

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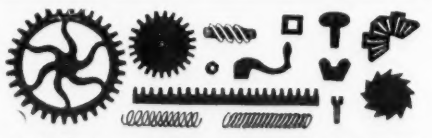

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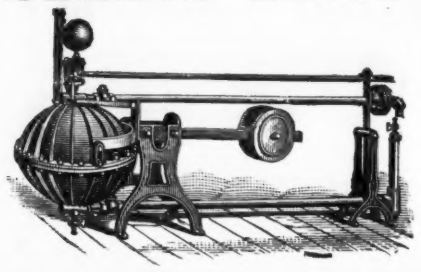

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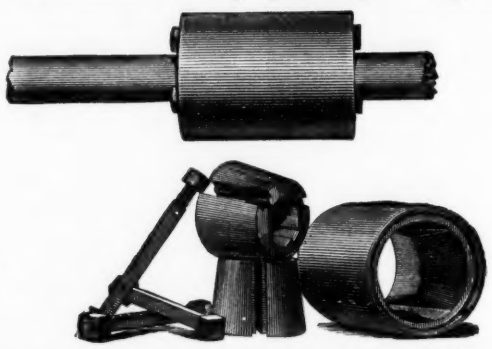

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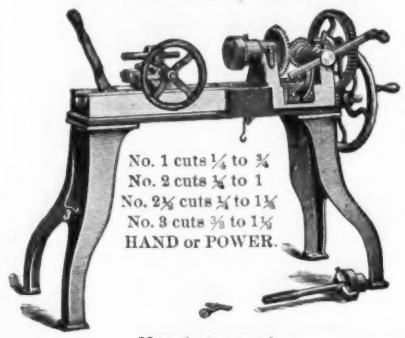

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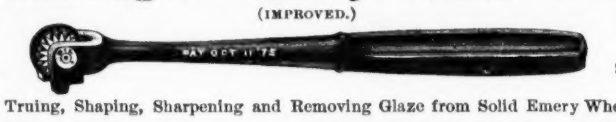

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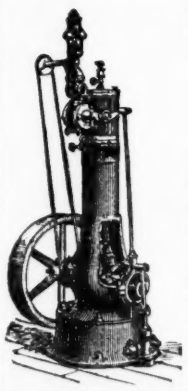

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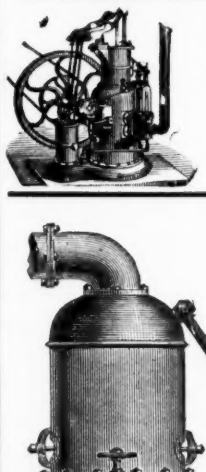

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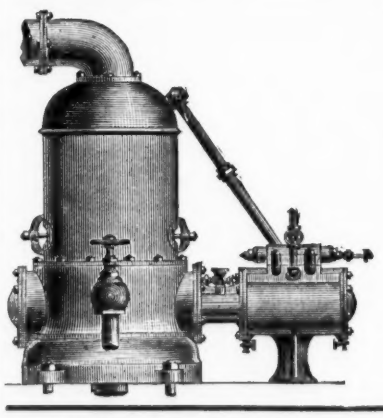

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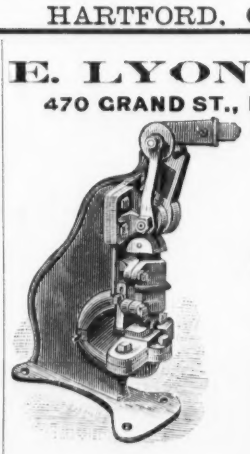

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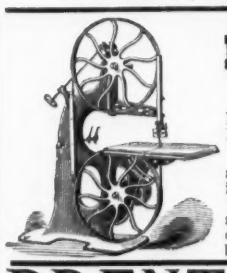

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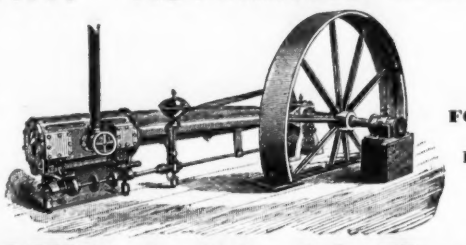

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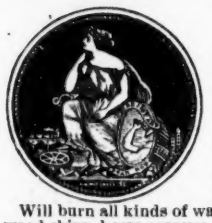

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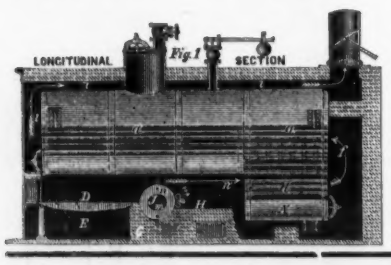

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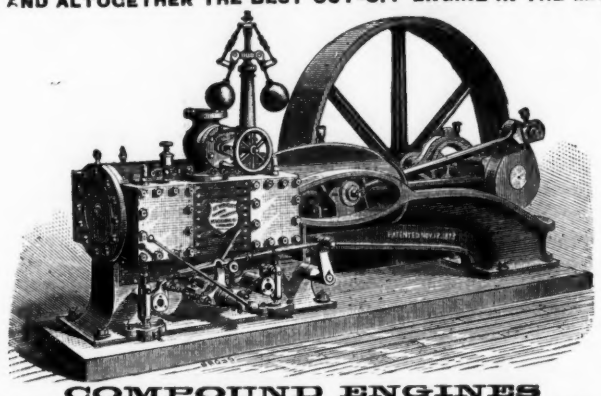

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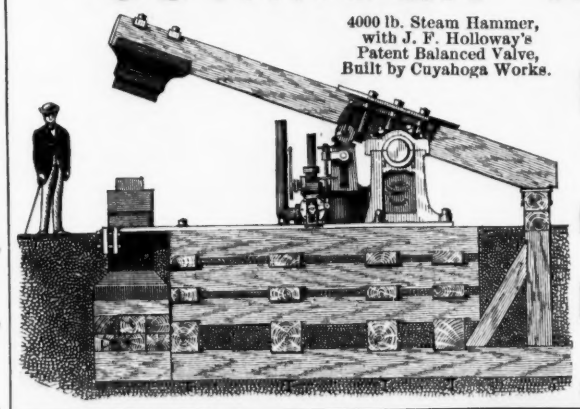

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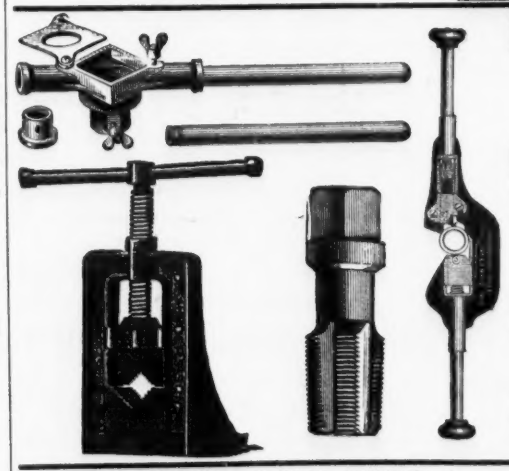

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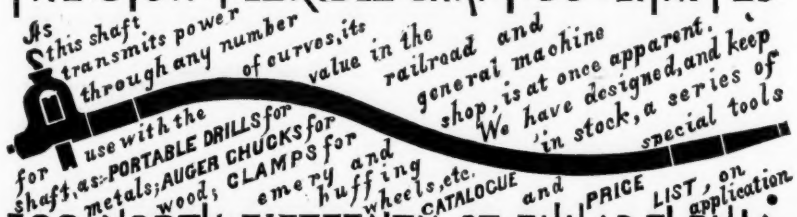
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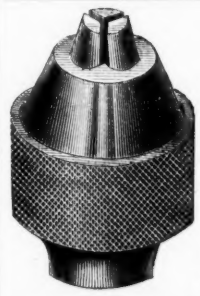

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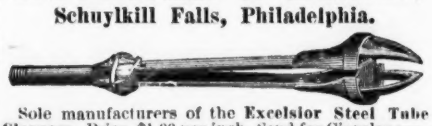

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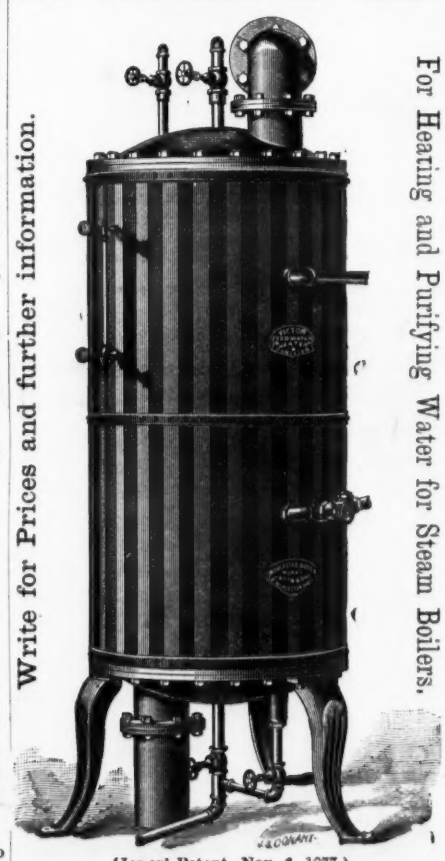

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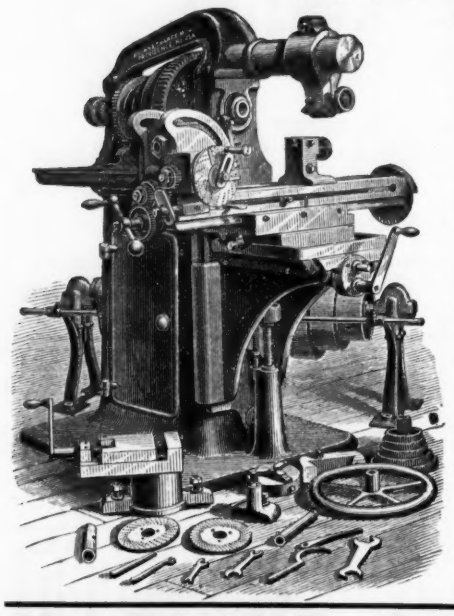

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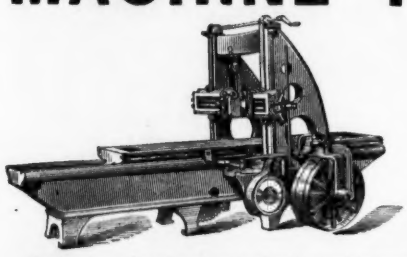

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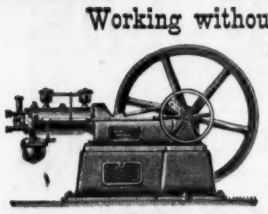

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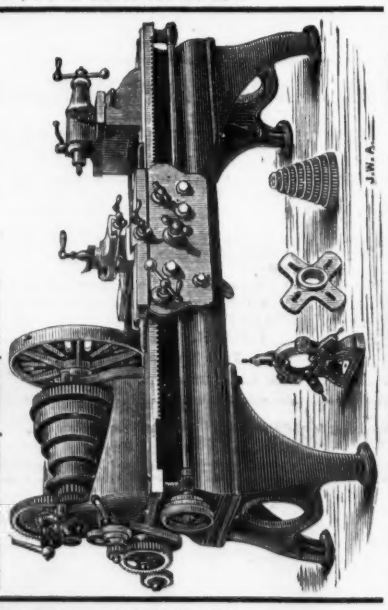

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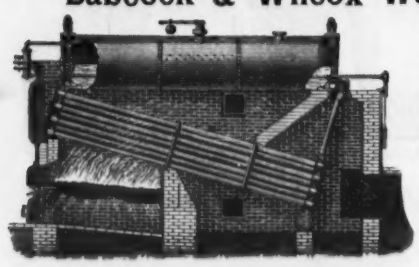

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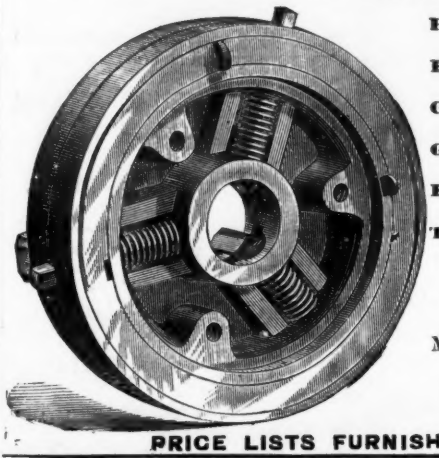

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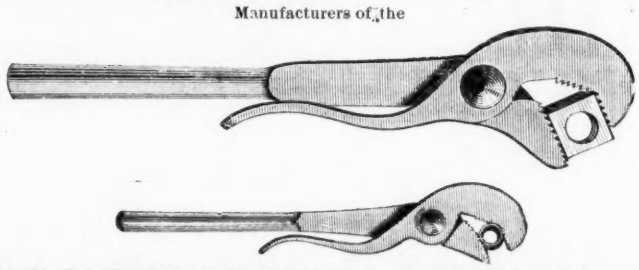

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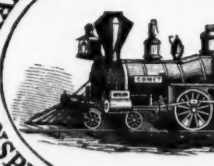

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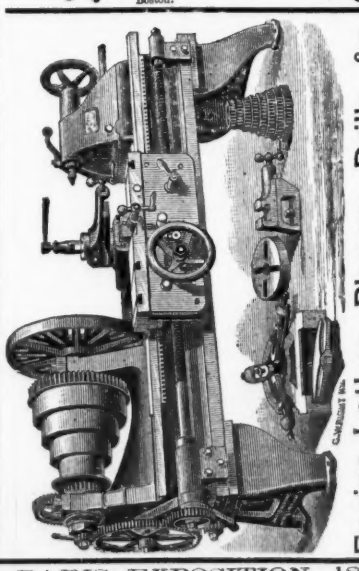

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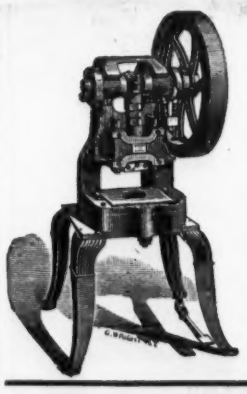

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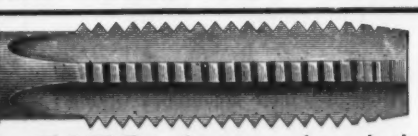

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